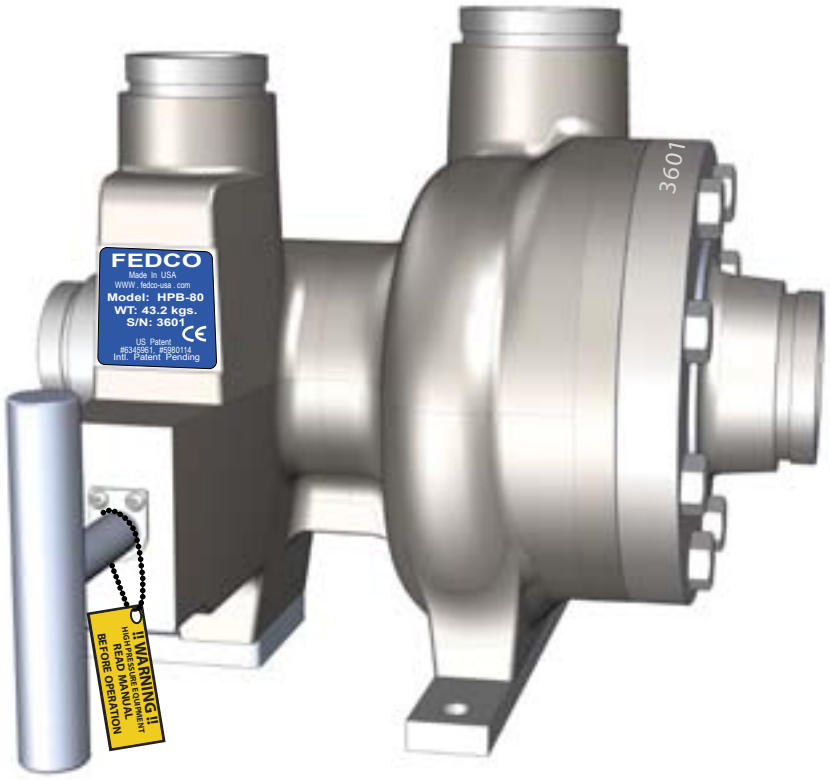
HYDRAULIC PRESSURE BOOSTER (HPB™)

Installation, Operation, Maintenance & Service Manual

Models: HPB-10 ● HPB-20 ● HPB-30 ● HPB-40
HPB-60 ● HPB-80 ● HPB-120 ● HPB-160



Register the product warranty at the time of installation by completing the Warranty Registration Form at the rear of this manual and fax or e-mail it to FEDCO.

Warranty Registration should be sent to:

ATTN: Field Service Department
FEDCO
800 Ternes Drive
Monroe, MI 48162
USA

Additional Contact Information:
Tel 734-241-3935
Fax 734-241-5173
Web site: www.fedco-usa.com
Choose the "Service and Support" tab

! IMPORTANT: FOR REASONS OF SAFETY AND MAINTENANCE, ONE COPY OF THIS MANUAL MUST REMAIN WITH THE EQUIPMENT AT ALL TIMES.

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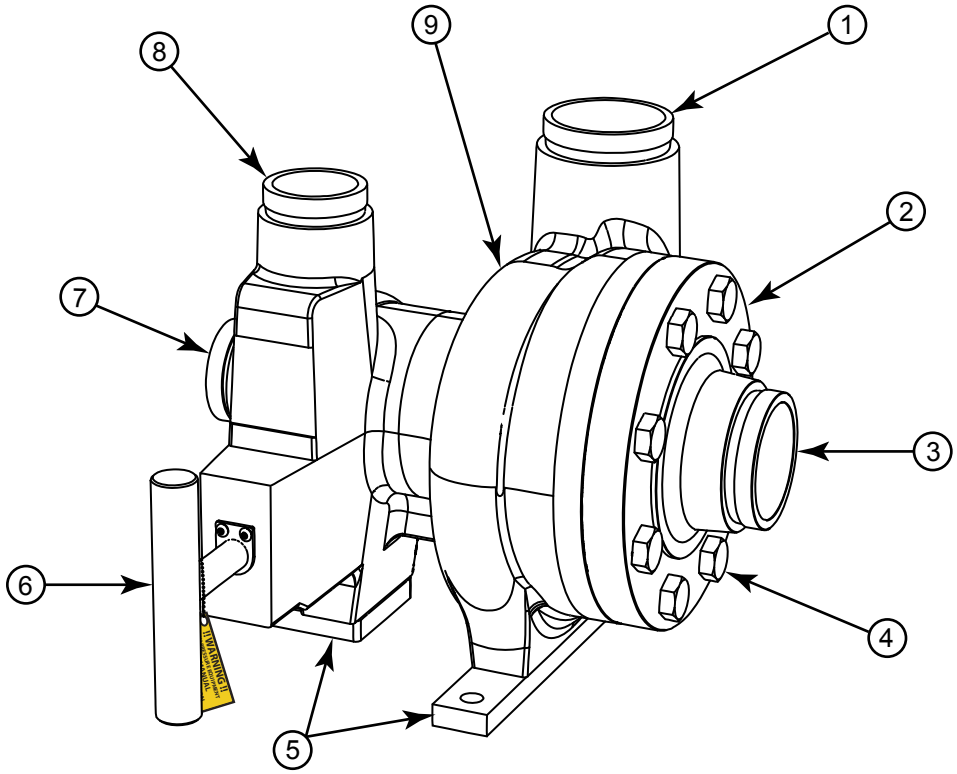
Theory and Operation

HPB External Components

The Hydraulic Pressure Booster™ or HPB™ is designed to provide brine energy recovery in reverse osmosis (RO) systems. The HPB™ is energized by the high-pressure brine stream which causes the HPB™ to generate a large pressure boost in the feed stream independent of the high pressure feed pump.

Typical HPB Booster External Components



Item	Description	Item	Description
1	Feed outlet	6	Auxiliary nozzle valve
2	End cap	7	Brine outlet
3	Feed inlet	8	Brine inlet
4	End cap bolt	9	Casing
5	Mounting feet		

Figure 1 HPB Booster External Components

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Theory and Operation (cont.)

HPB Energy Recovery Flow

The HPB™ is typically installed between the high pressure feed pump and the membrane (Figure 2). The feed passes through the pretreatment system and then passes through the feed pump which raises the feed pressure. The pressurized feed passes through the HPB™, which provides an additional pressure increase before passing to the membrane. The membrane produces a high-pressure brine stream which is directed back to the HPB™.

The HPB™ recovers the pressure energy and discharges the brine at low pressure for disposal. The HPB™:

- does not require a brine disposal pump.
- gravity flow piping as the brine can be discharged against a back pressure.
- reduces feed pump energy consumption.
- allows use of a smaller feed pump, smaller motor, smaller motor starter, electrical wiring, etc.

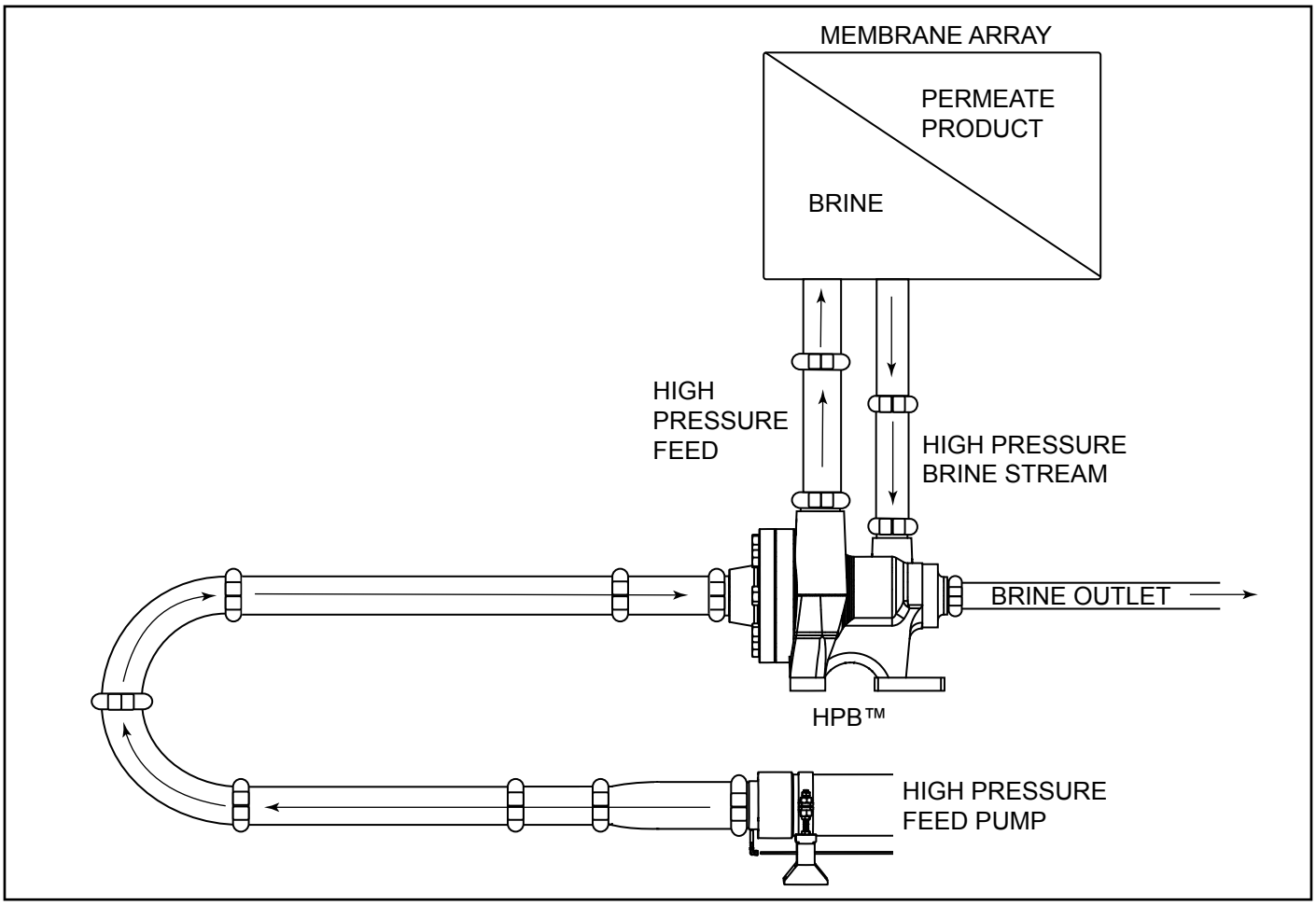

Figure 2 Hydraulic Pressure Booster Flow

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Installation Procedures

Warnings and Safety Precautions

Safety practices and precautions for the operation and maintenance of all FEDCO products MUST BE FOLLOWED. This information supplements oral or written instructions that may be received. Safety MUST be practiced as part of the standard operating procedures for this equipment during any installation and operation. To ensure that safe operating and maintenance procedures are followed, operators should develop and keep up a program of safety checks and current instructions. This manual contains certain operating and maintenance rocedures that involve exposure to potentially hazardous situations. The levels of hazardous situations are as follows:

DANGER

Hazards which are IMMEDIATELY ACCESSIBLE, and capable of causing SEVERE PERSONAL INJURY OR DEATH.

WARNING

Hazards which are NOT IMMEDIATELY ACCESSIBLE, but are capable of causing SEVERE PERSONAL INJURY OR DEATH.

CAUTION

Hazards which are NOT IMMEDIATELY ACCESSIBLE, and can cause PERSONAL INJURY.

ELECTRICAL HAZARD

Hazards which are related to Electrical Components and can RESULT IN ELECTRICAL RISKS, SHOCK, ELECTROCUTION OR DEATH if instructions are not followed properly.

PUNCTURE HAZARD

Hazards which are NOT IMMEDIATELY ACCESSIBLE and can RESULT IN SEVERE PERSONAL INJURY OR DEATH if instructions are not followed properly.

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Installation Procedures (cont.)

WARNING

All booster and safety precautions must be followed to prevent physical injury to the operator. It is illegal to operate the equipment in an EU member state, which requires CE compliance, if the manual is not written in that state's language. If a translation is needed, please contact a FEDCO representative.

CAUTION

A hydraulic pressure booster is a pressure-generating device with rotating parts that can be hazardous. Any device containing generated pressure can rupture, explode or discharge its contents if it is sufficiently over-pressurized and may possibly result in personal injury, property damage, environmental damage and death. All necessary precautions must be exercised to insure over-pressurization does not occur. FEDCO will not accept responsibility for physical injury, damage or delays caused by a failure to observe the instructions in this manual.

WARNING

Installation, operation or maintenance of the booster unit in any manner which is not covered in this manual could cause damage to the equipment, serious injury or death. This includes any modification to the equipment or the use of parts not provided by FEDCO. If there is a question regarding the intended use of the equipment, please contact a FEDCO representative before proceeding.

CAUTION

This manual clearly identifies accepted methods for safe disassembly. These methods must be strictly adhered to.

WARNING

Do not use the booster equipment for a different application than originally specified without the approval of a FEDCO representative.

WARNING

NEVER operate the booster equipment:

- below the minimum flow rate.
- when dry.
- without priming.
- without proper guards and safety devices installed.
- with the discharge valve closed.
- with the suction valve closed.

User Health and Safety

Safety Equipment should be used in accordance with company regulations. The following safety equipment should be used within the work area:

- Helmet.
- Safety Glasses with shields or goggles.
- Safety Shoes.
- Protective Gloves.
- Hearing Protection is recommended.
- Follow safe lifting methods to avoid personal injury.

In the Work Area

- Always keep the work area clean and dry.
- Avoid all electrical dangers. Be aware of risks from electric shock or arc flash hazards.
- Utilize adequate lifting equipment and methods.

Booster Installation Requirements

A rigid mounting surface is required for the hydraulic booster assembly in order to prolong the life of critical components. Mounting surfaces constructed of wood or other non-rigid materials are NOT acceptable as they may distort the booster casing resulting in misalignment. All anchoring fasteners used should meet or exceed manufacturers specifications. All assemblies must be mounted on one of three types of substrates:

- concrete foundation.
- optional baseplate.
- container with a suitable steel substructure.

Inspection of Unit Upon Receipt

- Review the contents of the packing list to make sure all components have been included.
- Inspect all components for signs of damage which may have occurred during shipping.
- If damage is present or if the contents are incomplete, please contact your shipping company or a FEDCO representative before proceeding.

Booster Storage Requirements

The HPB™ unit must be protected from sand, grit, and other foreign matter. For long-term storage, the booster and all other components should remain in their original un-opened crate. Both the unit and its actuator (if equipped) are wrapped and sealed in water/humidity proof foil with desiccant bags added. The unit may be stored at a temperature of 50° C or less and/or a humidity level or 75% or less for an indefinite period of time. Do not remove the protective covers until ready to install.

Pre-Installation

In some instances, the HPB is shipped pre-attached to its MSS high pressure feed pump. Usually, the HPB unit will be shipped in its own crate. The crate also contains a rotor removal tool for HPB overhaul service (Figure 3).

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Installation Procedures (cont.)

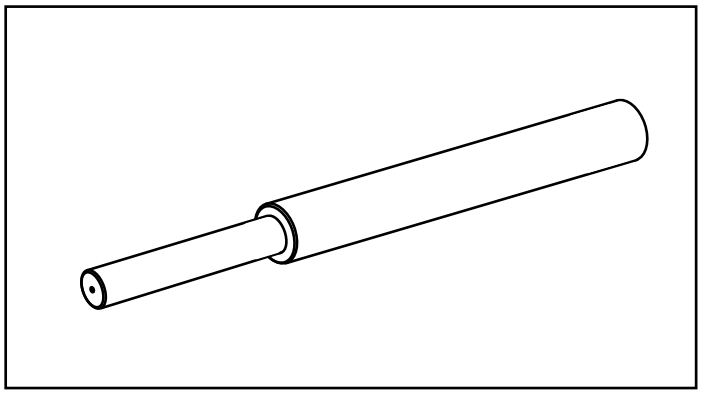

Figure 3 Rotor Removal Tool

Figure 4 HPB Unit Nameplate

Lifting and Handling

CAUTION

Observe all lifting precautions. Failure to follow all lifting and handling precautions may result in serious injury! Unit weight is listed on the unit nameplate (Figure 4). Determine the weight of the unit to select an appropriate lifting method. Suitable lifting equipment such as lifting straps should always be used to prevent damage to the equipment. Always make sure the lifting straps are properly cinched around the unit (Figure 6).

HPB Lifting

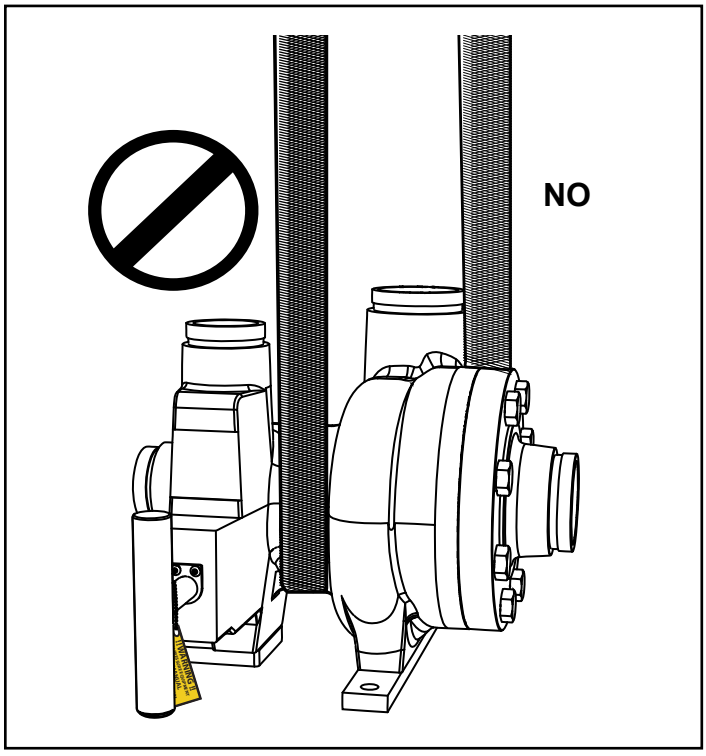

Figure 5 Improper MSS-HPB Lifting Points

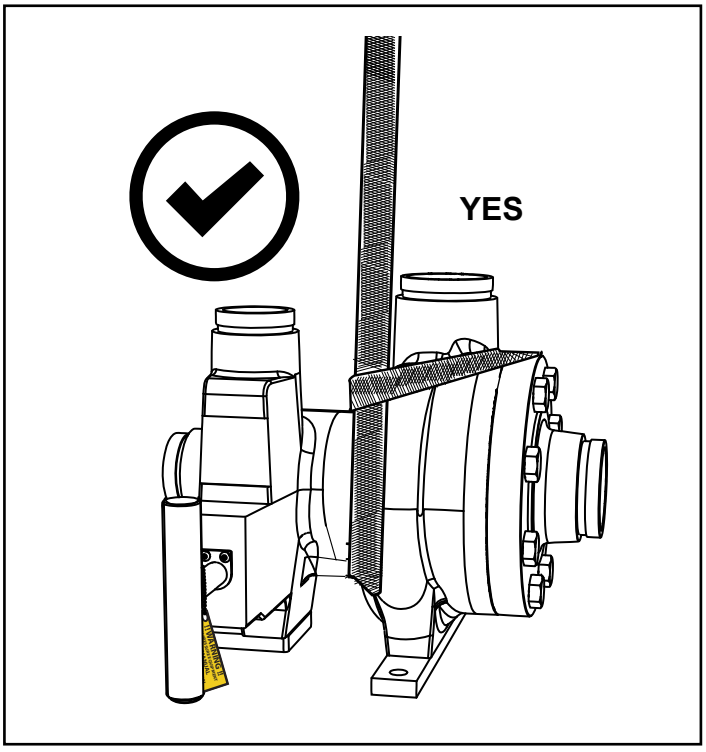

Figure 6 Proper MSS-HPB Lifting Points

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Installation Procedures (cont.)

Baseplate Installation

Two different baseplate designs are used for HPB models 10 through 160 (Figure 7). The baseplate design is dependant on the size of the booster. HPB-20 through HPB-60 uses a one-piece high density polymer base. HPB-80 through HPB-160 uses a two-piece stainless steel baseplate. Each provides a good mounting surface for the booster. Although each baseplate is precisely manufactured, it requires a solid foundation such as a concrete pad or rigid steel substructure. The baseplate should be installed first to avoid distortion which may occur due to uneven floors or substructure (Figure 8). If the booster is installed within a container, it must be mounted on a rigid steel substructure that will not distort under the weight of the equipment or from torque reaction forces during booster operation.

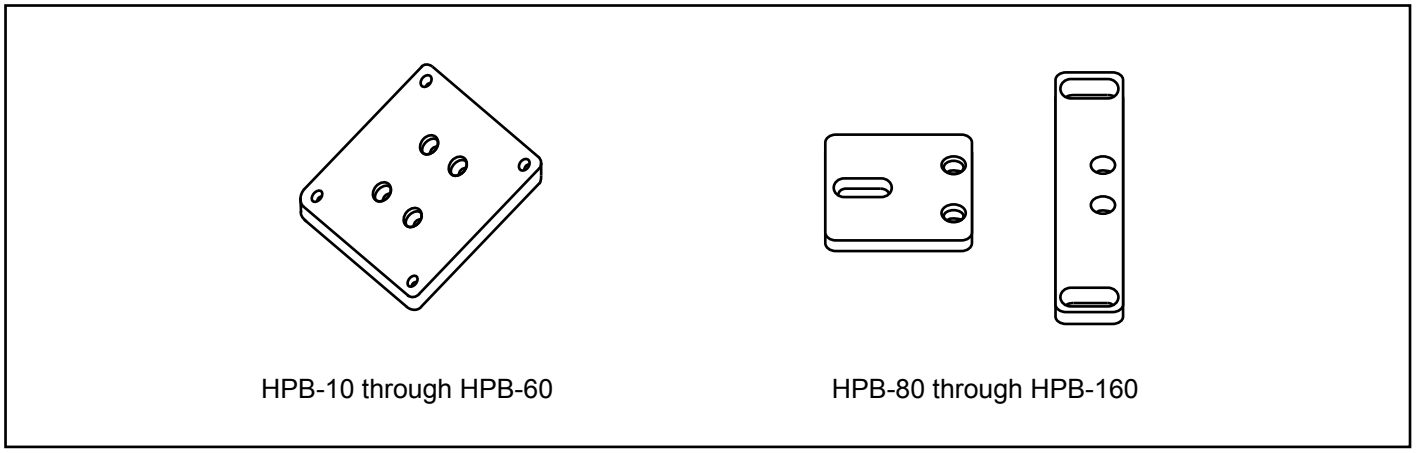

Figure 7 Baseplate Designs

Foundation Specifications

A concrete foundation is recommended for all HPB installations. Concrete provides good support and good vibration absorption. The foundation should have a mass that is 50% more than the total weight of the equipment and its perimeter should extend at least 6 inches (15 cm) on each side from the booster. Make sure the concrete is completely dry and level before installing any machinery. Make sure anchor bolts and shims are properly sized and installed in cases of uneven surfaces (Figure 9).

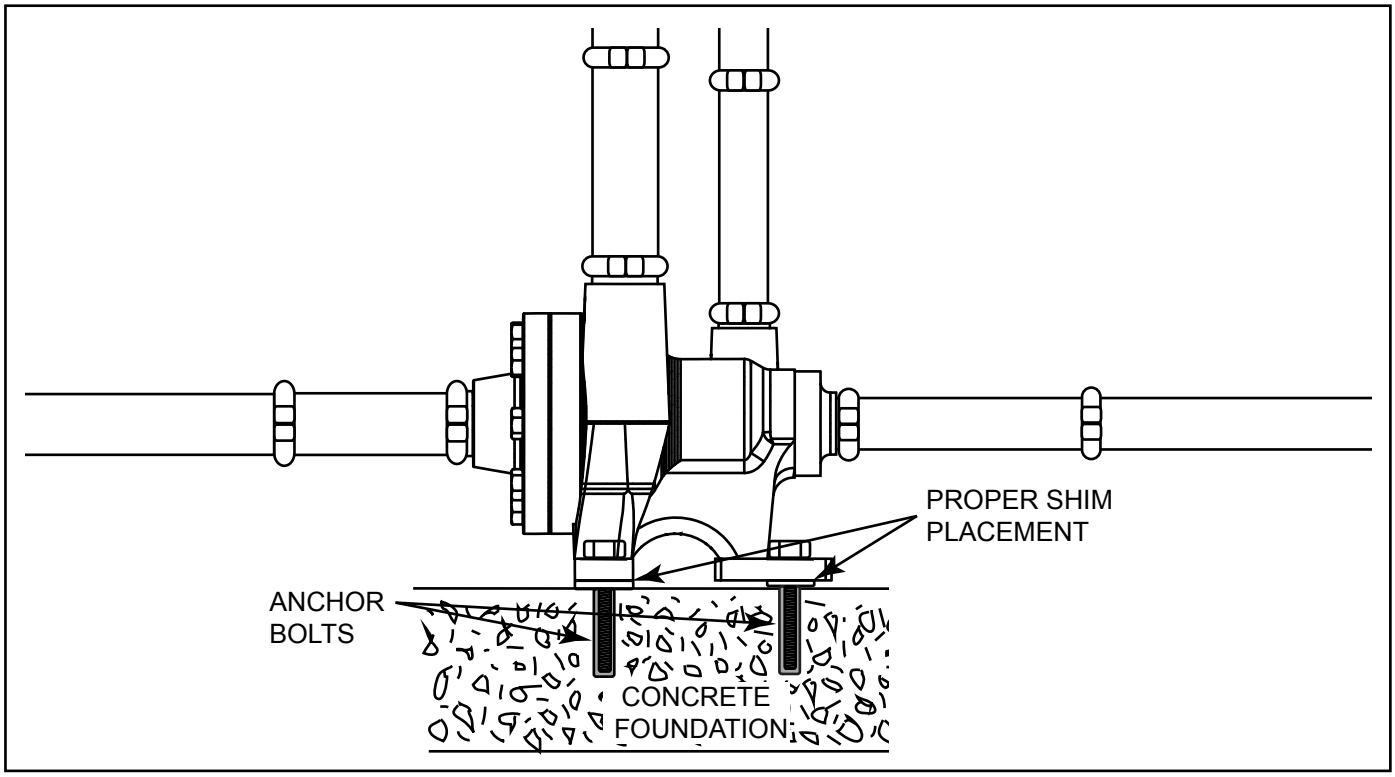

Figure 8 Proper Shimming

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Installation Procedures (cont.)

Installation Configurations

High Pressure Centrifugal Feed Pumps

In some cases, a throttle valve is needed to regulate feed pump discharge pressure. The throttle valve should be located between the feed pump and the HPB feed inlet (Figure 9). The minimum distance between the high pressure cetrifugal feed pump and the throttle valve can be calculated by multiplying the pipe diameter by 3. If the high pressure feed pump speed is controlled by a variable frequency drive (VFD), a throttle valve is not required.

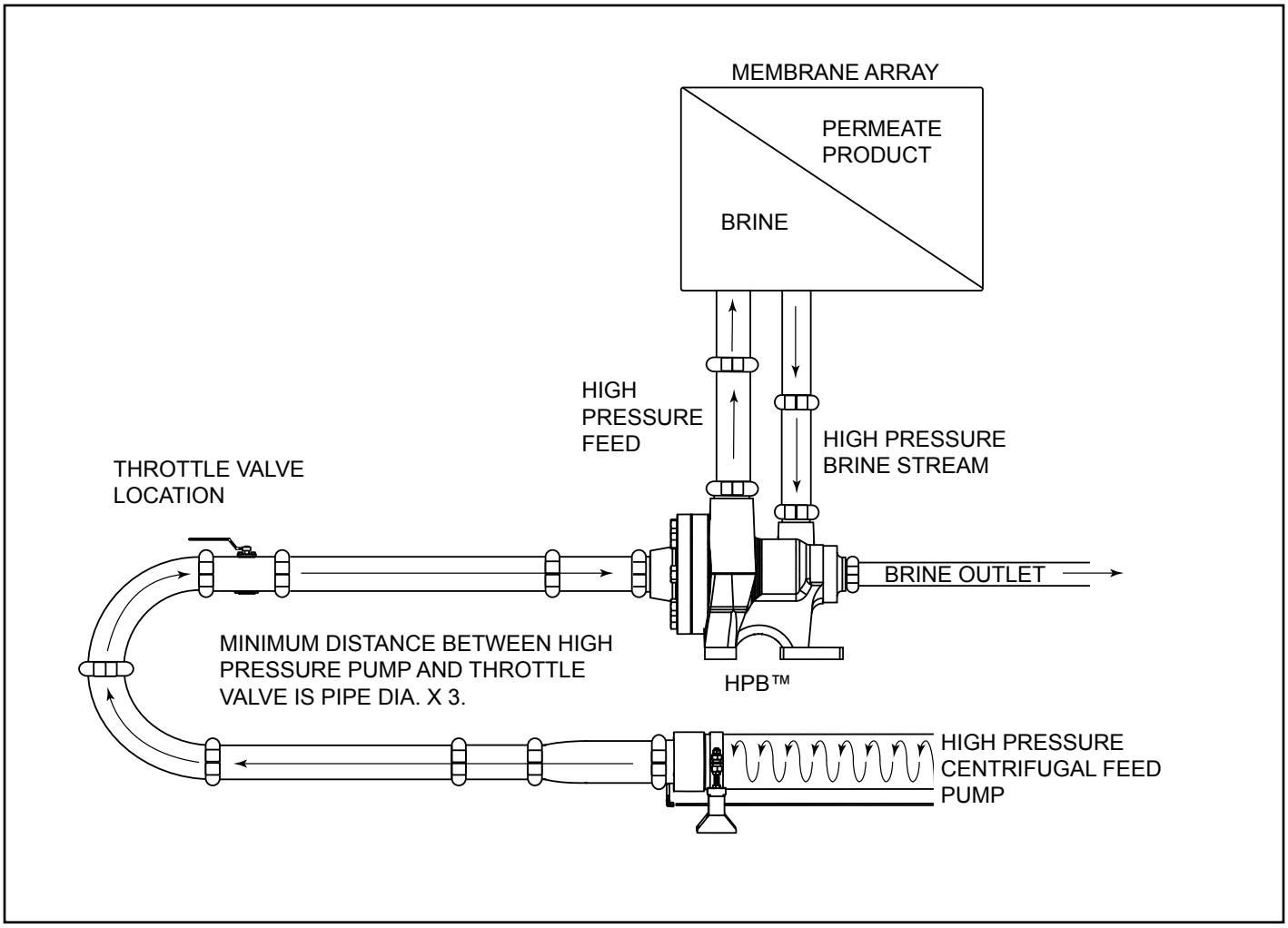

Figure 9 Centrifugal Feed Pump Configuration

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Installation Procedures (cont.)

Positive Displacement (DP) High Pressure Feed Pumps

With a positive displacement (PD) feed pump configuration, DO NOT use a throttle valve. A pulsation dampener is required and should be installed between the outlet of the feed pump and the HPB feed pump inlet (Figure 10). The pulsation dampener should be adjusted according to the feed pump discharge pressure with the HPB in operation. A pressure relief valve is also necessary and should be installed between the HPB feed outlet and the system membrane inlet.

CAUTION

If the feed pump and motor are not rated for operation at full membrane pressure, a second pressure relief valve must be installed to prevent motor and feed pump overload if the HPB becomes inoperative (Figure 10).

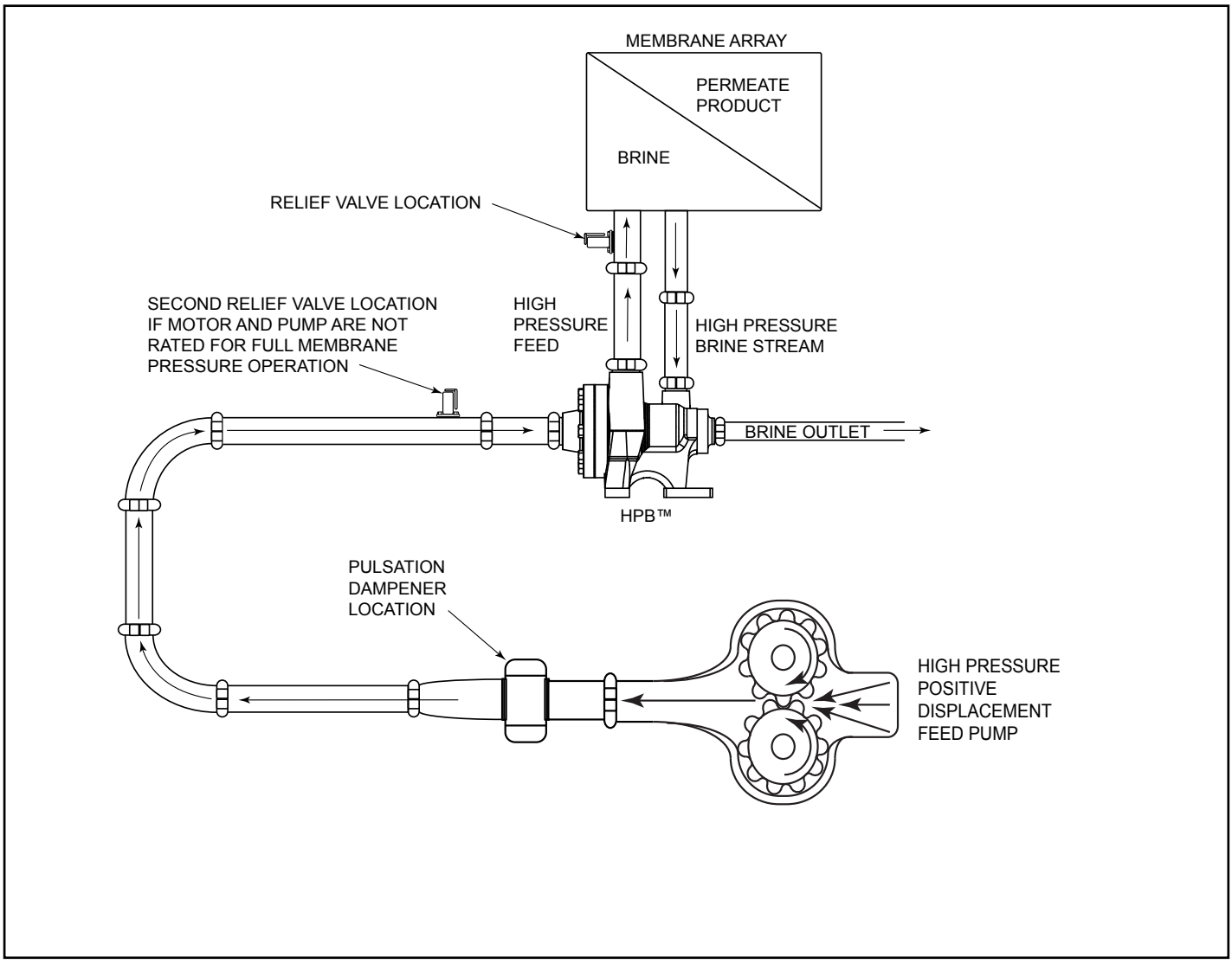

Figure 10 Positive Displacement Feed Pump Configuration

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Installation Procedures (cont.)

Booster Piping Connections

Piping Alignment

- Accurate alignment and support of all piping connected to the booster is critical (Figure 11).
- Any movement occurring at the inlet or discharge booster connections may cause booster misalignment and stress over time.
- Do not force any misaligned pipes to connect to the booster discharge or inlet.

Pipe Couplings

- Use only grooved type couplings at all booster and pipe connections (Figure 12).
- Follow all manufacturer installation and torque specifications.
- Align all piping carefully before installing couplings.
- DO NOT use couplings to force piping to align. Make sure all seals seat correctly inside the coupling.
- If piping or seals are not aligned correctly, leaking may occur under pressure.

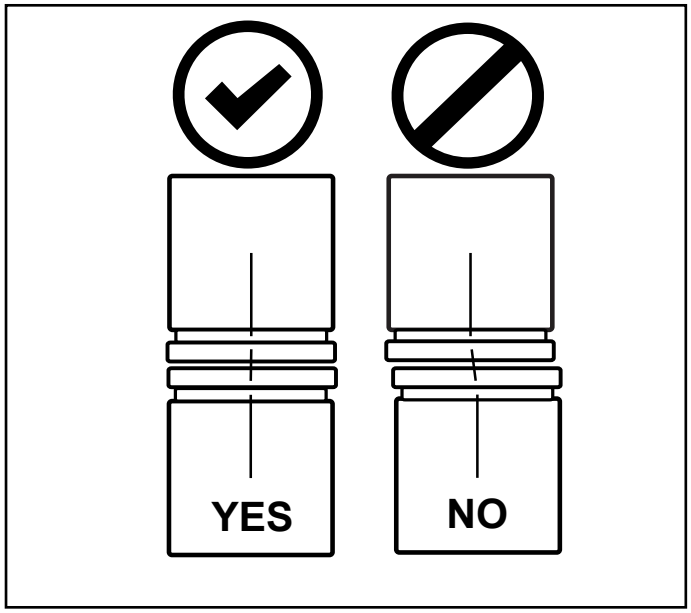

Figure 11 Proper Piping Alignment

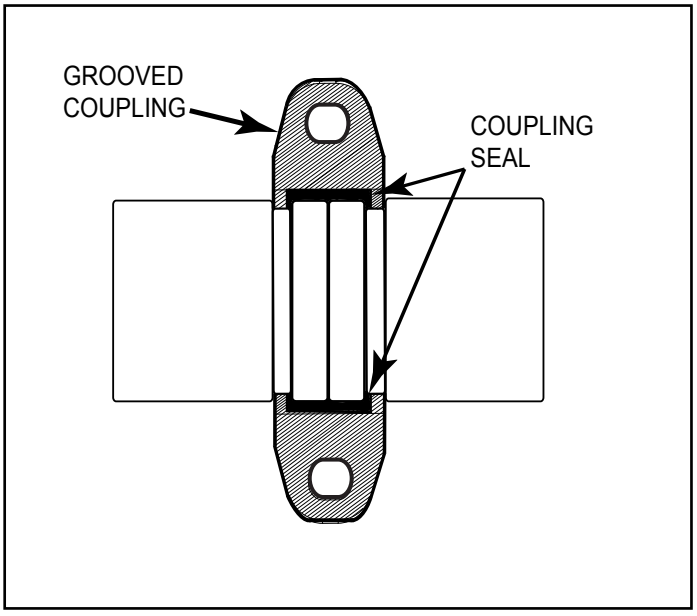

Figure 12 Typical Grooved Coupling

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Installation Procedures (cont.)

Inlet Piping
Keep the inlet pipe free of high points which could trap air and could disrupt booster operating. Pressure gages are recommended to allow measurement of booster inlet pressure.

Outlet Piping
All piping connected to the booster should have removable sections such as a spool piece or elbow to allow for booster service (Figure 13).

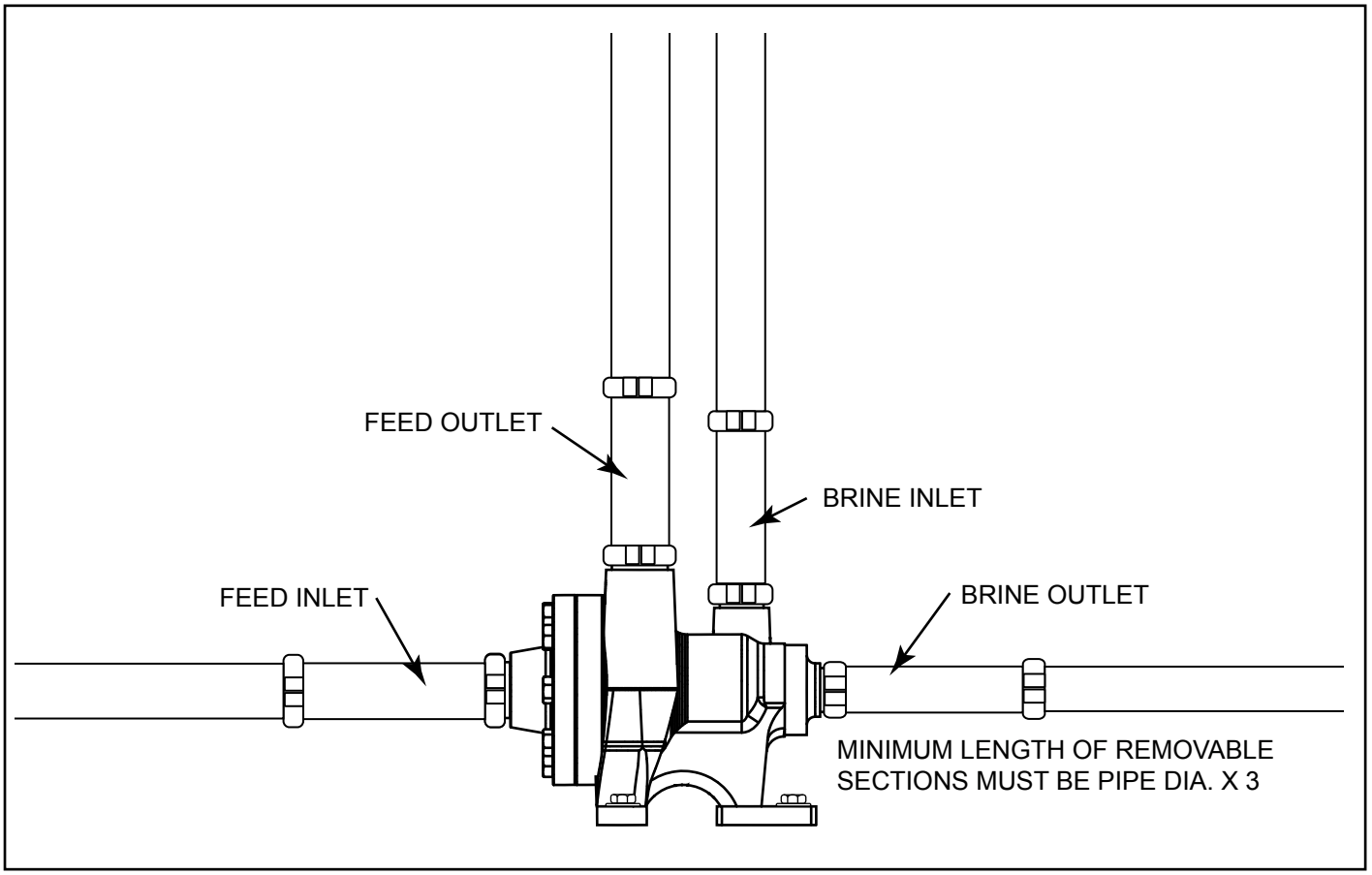

Figure 13 Removable Sections for Booster Service

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Installation Procedures (cont.)

Recommended Instrumentation and Operation

For safe booster operation, a pressure switch should be installed at the MSS feed pump inlet to prevent pump operation if the feed pressure to the pump is below minimum (Figure 14). Pressure gages should be installed at all four points going into and out of the HPB to monitor booster performance. Refer to the rear of the HPB startup tag for equipment specifications (Figure 15).

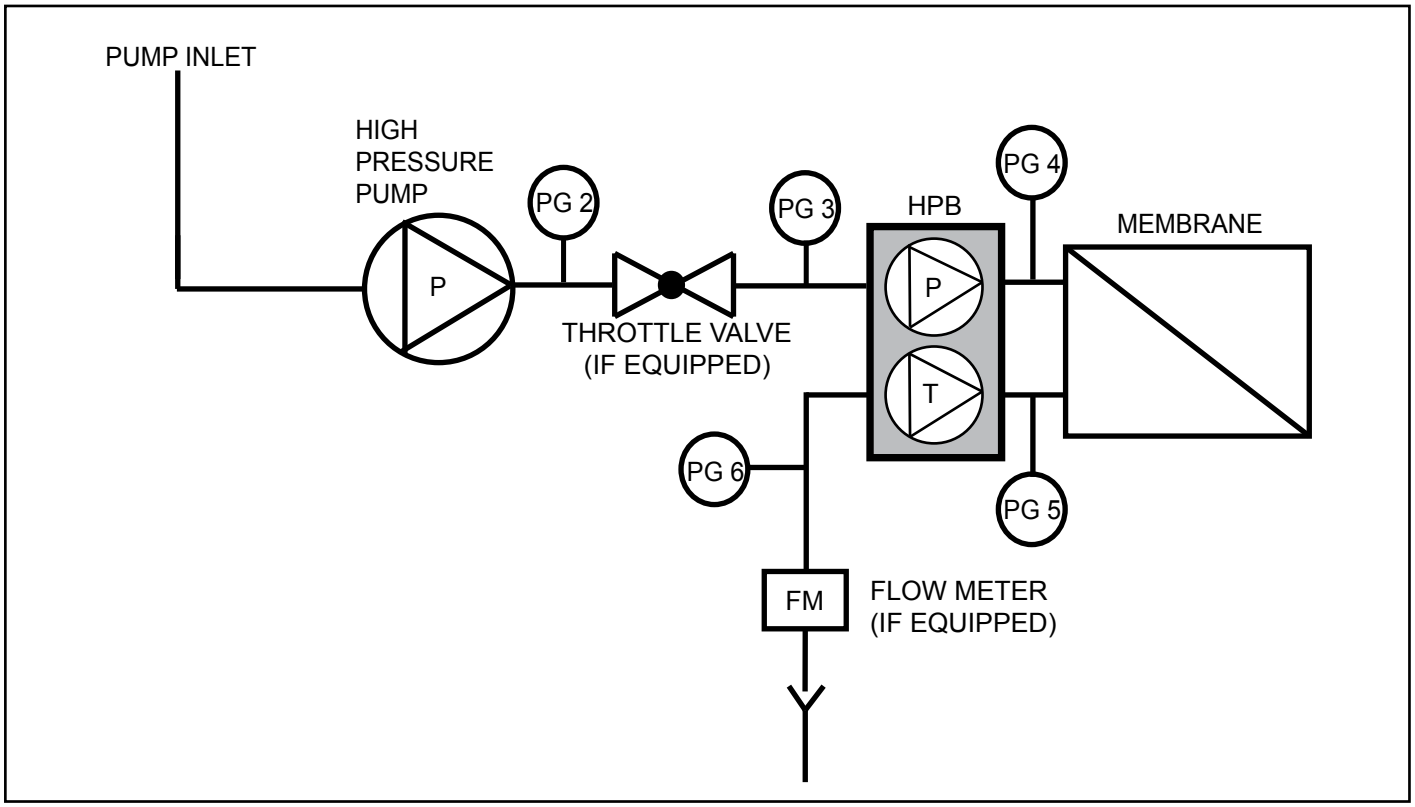
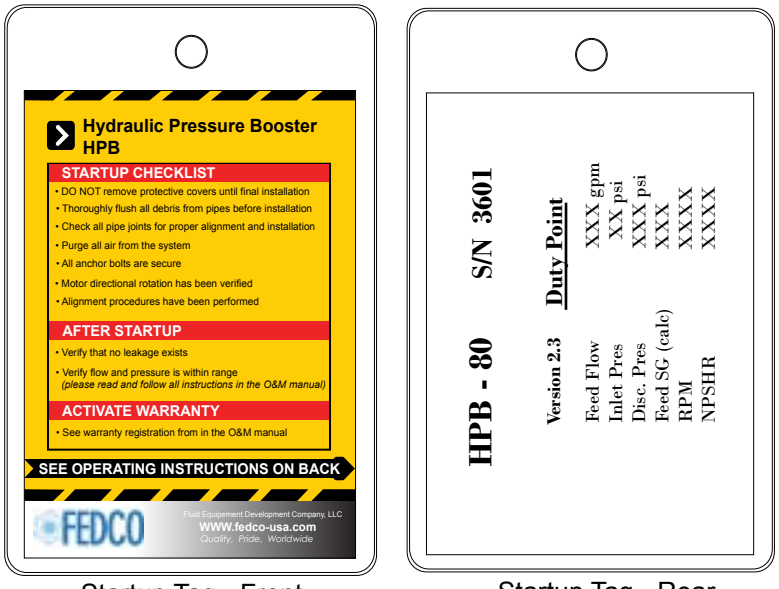


Figure 14 Recommended Instrumentation


Hydraulic Pressure Booster
HPB
STARTUP CHECKLIST
• DO NOT remove protective covers until final installation
• Thoroughly flush all debris from pipes before installation
• Check all pipe joints for proper alignment and installation
• Purge all air from the system
• All anchor bolts are secure
• Motor directional rotation has been verified
• Alignment procedures have been performed
AFTER STARTUP
• Verify that no leakage exists
• Verify flow and pressure is within range
(please read and follow all instructions in the O&M manual)
ACTIVATE WARRANTY
• See warranty registration from in the O&M manual
SEE OPERATING INSTRUCTIONS ON BACK
FEDCO
Fluid Equipment Development Company, LLC
WWW.fedco-usa.com
Quality, Pride, Worldwide
HPB - 80
S/N 3601
Version 2.3
Duty Point
Feed Flow XXX gpm
Inlet Pres XX psi
Disc. Pres XXX psi
Feed SG (calc) XXX
RPM XXXX
NPSHR XXXX

Startup Tag - Front

Startup Tag - Rear

Figure 15 HPB Startup Tag

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Upstream Filtration

- The booster must be protected from debris in the feed water such as sand, gravel, or other particulate matter.
- A 20 micron filter must be installed upstream of the feed pump inlet to protect against foreign matter entering the system.
- Temporary strainers should be installed after initial start up or repairs to protect the pump and booster from possible debris.

Preparation for Booster Start Up

Start Up Precautions

WARNING

NEVER operate the booster equipment when dry. make sure all mounting bolts are tightened to specification and couplings are securly fastened.

Start Up Check List

An additional Start Up Check List is available in the rear of this manual. Also use the Start Up Record at the rear of this manual to record initial operating conditions at booster start up.

- ☐ All anchor bolts tightened to specifications.
- ☐ All pipe couplings tightened to specifications.
- ☐ Inlet pressure switch (if applicable) installed.
- ☐ System pipes are clean and upstream filtration in place.
- ☐ System leak checked and all air vented from system.
- ☐ ALL safety devices in place.

Booster Start Up

NOTE: Use the “Start Up Record” located in the rear of this manual to record initial operating conditions at booster start up.

1. Start the low pressure feed pump and vent the air from the system.
2. Verify that there are no leaks in the system.

Centrifugal Feed Pump:

3. Turn the HPB auxiliary nozzle valve to the fully closed position and make sure any by-pass or clearing valves are closed.
4. If used, make sure the throttle valve opening is set at appriximately 50%.

Positive Displacement Pump:

3. Turn the HPB auxiliary nozzle valve to the fully open position.
4. Set the pulsation dampener for the expected feed pump discharge pressure.

5. Activate the high pressure feed pump.
6. Observe any unusual system noise or vibration.
7. If a vibration meter is available, record a baseline vibration reading at this time.
8. Observe and record all pressure and flow readings.
9. Adjust system valves and controls as needed to obtain

Feed Pump Type	Increase Permeate Flow	Decrease Permeate Flow
Centrifugal	Open throttle valve and close auxiliary nozzle valve or increase VFD frequency output.	Close throttle valve and open auxiliary nozzle valve or decrease VFD frequency output.
Positive Displacement	Close auxiliary nozzle valve.	Open auxiliary nozzle valve.

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Basic Troubleshooting

If the booster does not operate properly, refer to the following troubleshooting charts as a guide to determining the concern and identifying the potential cause. If after consulting the troubleshooting charts the cause is still undefined, contact FEDCO technical support by e-mail (techsupport@fedco-usa.com), telephone or FAX. FEDCO will give you easy, step by step instructions on how to proceed.

Visual Inspection

- Make sure all items are accounted for on the start up check list.
- Inspect all high pressure booster piping.
- Inspect the booster mountings for signs of any movement or vibration.
- Inspect pressure gauges, switches and all other instrumentation for proper operation.
- Record any unusual readings.

The amount of pressure boost depends on many factors including:

- brine flow.
- brine pressure.
- feed flow.
- auxiliary nozzle valve setting.

If the feed pressure boost is not as specified, record the pressures and contact FEDCO Technical Support.

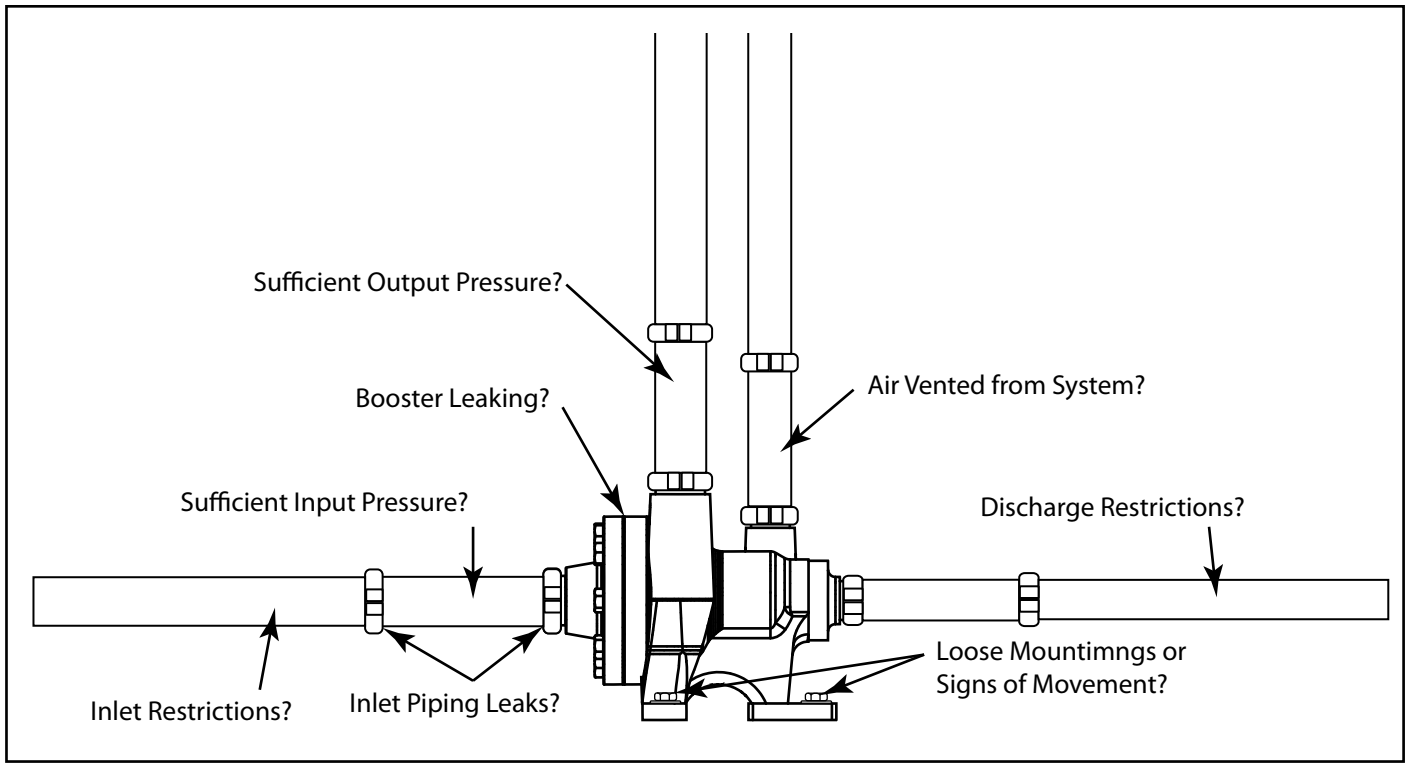

Figure 16 HPB™ Basic Visual Inspection

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BASIC TROUBLESHOOTING

Symptom	Possible Cause	Action
Low or no pressure boost	Incorrect feed pump speed or direction	- Check feed pump VFD for proper speed setting (if equipped) - Check feed pump power supply frequency (50 or 60 Hz) - Check rotational direction of feed pump motor
	Low permeate brine output pressure	- Check permeate membrane for brine restrictions.
	Restriction in inlet or discharge pipes	- Check feed pump discharge pressure - Check position of all auxiliary nozzle valve
	Design parameters	- Compare operating data to design data outlined in the technical proposal
	Thrust Bearing	- Inspect the thrust bearing for excessive or unusual wear causing excessive rotor end play
Booster Leaks	Pipe Joints	- Inspect pipe joints for insufficient sealing - Inspect booster for damaged O-rings
Booster vibration or noise	Booster cavitation	- Check feed pump discharge pressure during operation - Check for excessive flow rate
	Air in casing	- Purge air from all piping
	Rotor	- Check rotor thrust passages for debris or restrictions.

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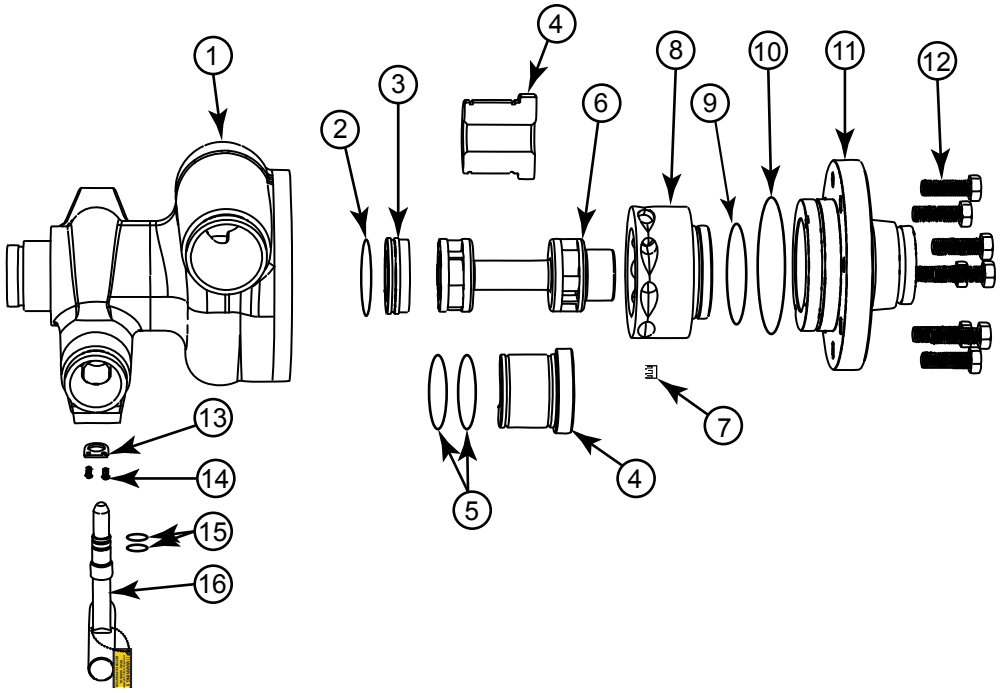
Booster Overhaul



Item	Description	Item	Description
1	Casing	9	Diffuser O-ring
2	Thrust bearing O-ring	10	End cap O-ring
3	Thrust bearing	11	End cap
4	Center bearing (split)	12	End cap bolts
5	Center bearing O-rings (2 Req'd)	13	Auxiliary nozzle valve retaining plate
6	Rotor	14	Retaining plate screws
7	Rotor filter	15	Auxiliary nozzle valve O-rings
8	Diffuser ring	16	Auxiliary nozzle valve

Figure 17 Booster Components

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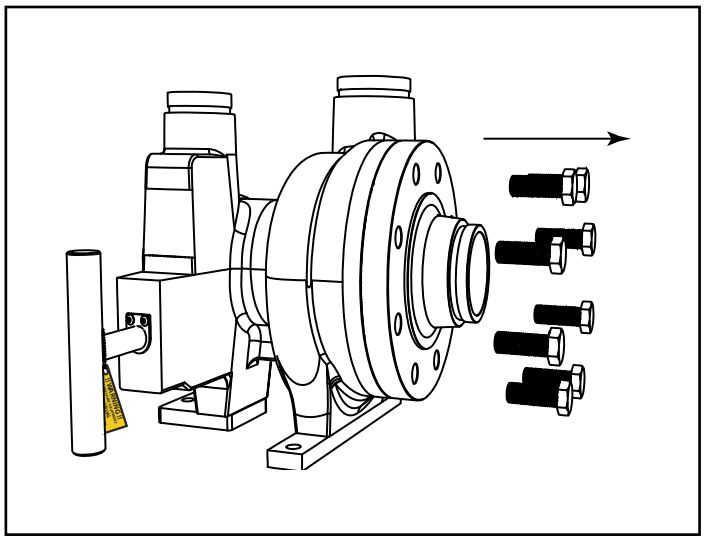

Figure 18 Removing End Cap Bolts

Booster Overhaul (cont.)

Disassembly

1. Drain the piping and booster.

2. Disconnect inlet and outlet piping as necessary.

3. Using suitable lifting equipment as necessary, place the booster on a suitable workspace.

4. Remove the end cap bolts (Figure 18).

   NOTE: The number of end cap bolts will vary depending on model.

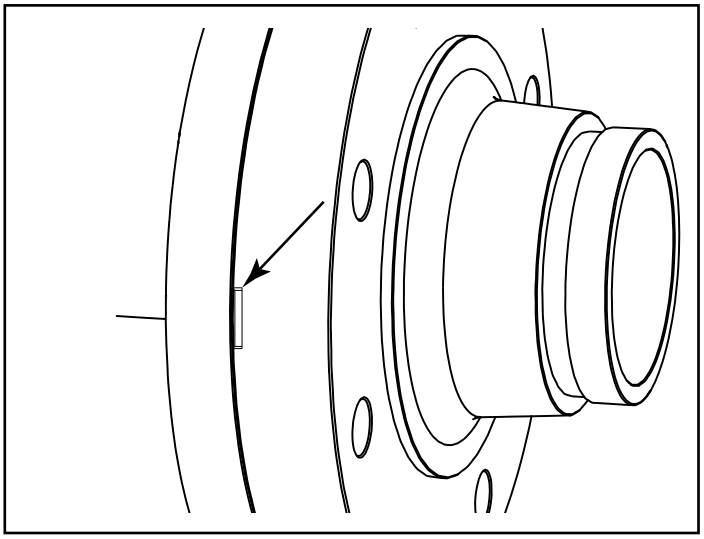

Figure 19 End Cap Notch Location

5. Locate the notches on both sides of the end cap and use a suitable tool to gently pry the end cap from the casing (Figure 19).

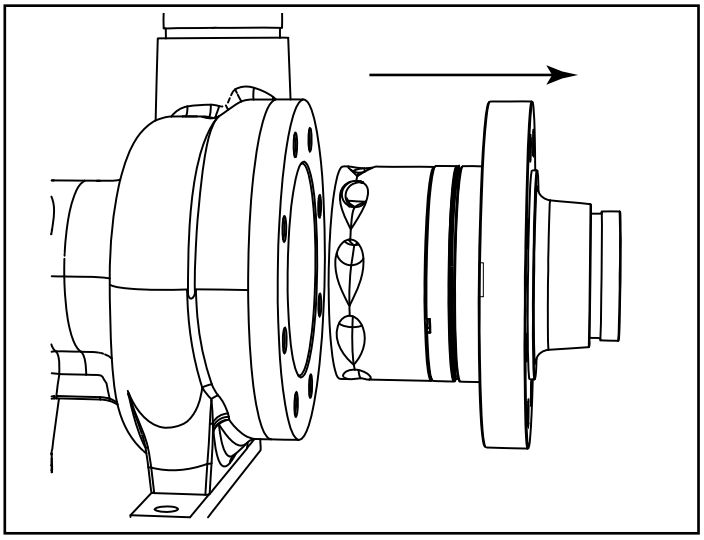

Figure 20 Removing End cap with Diffuser Ring

NOTE: During end cap removal, make sure to keep the end cap square to the booster casing. Pull the end cap straight out of the booster casing to prevent damaging the diffuser.

6. Remove the end cap with O-ring and diffuser ring (Figure 20).

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Booster Overhaul (cont.)

7. Locate the notches on the end cap and using a suitable tool, gently pry the diffuser ring with O-ring from the end cap (Figure 21).

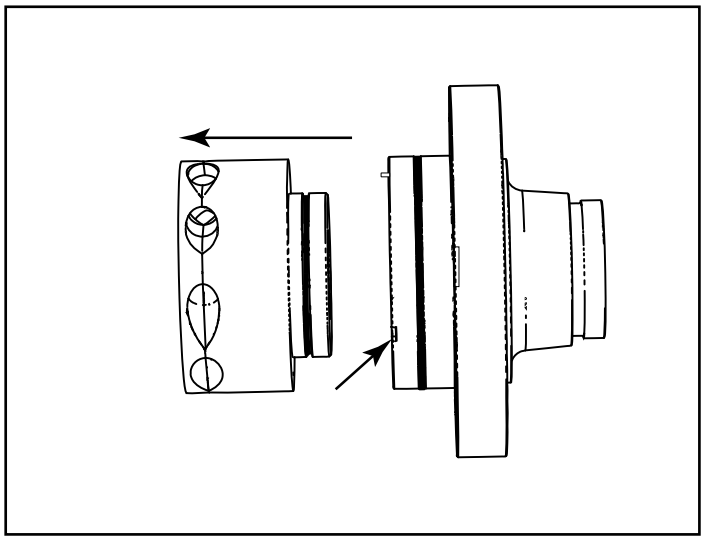

Figure 21 Separating Diffuser Ring From End Cap

8. Insert the rotor removal tool (provided) in through the brine outlet and gently tap the rotor assembly loose (Figure 22).

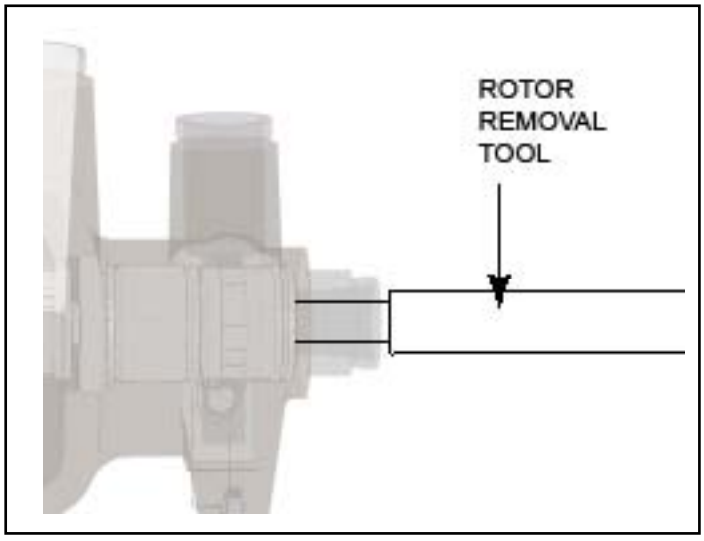

Figure 22 Loosening Rotor Assembly From Case

9. Remove the rotor assembly with the center bearing from the casing (Figure 23).

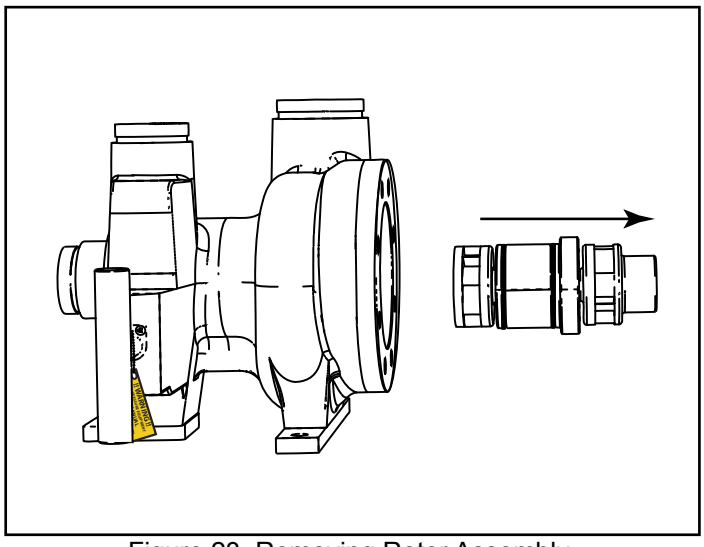

Figure 23 Removing Rotor Assembly

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Booster Overhaul (cont.)

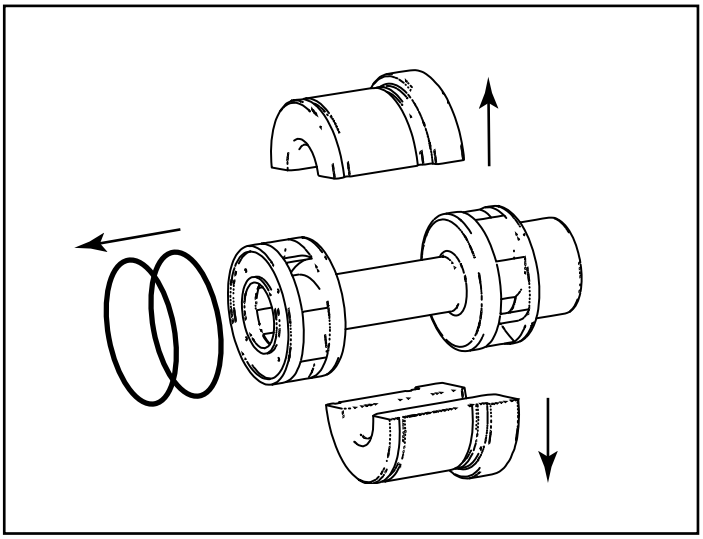

Figure 24 Separating Center Bearing From Rotor

10. Remove the two (2) center bearing O-rings and center bearing halves from the rotor (Figure 24).

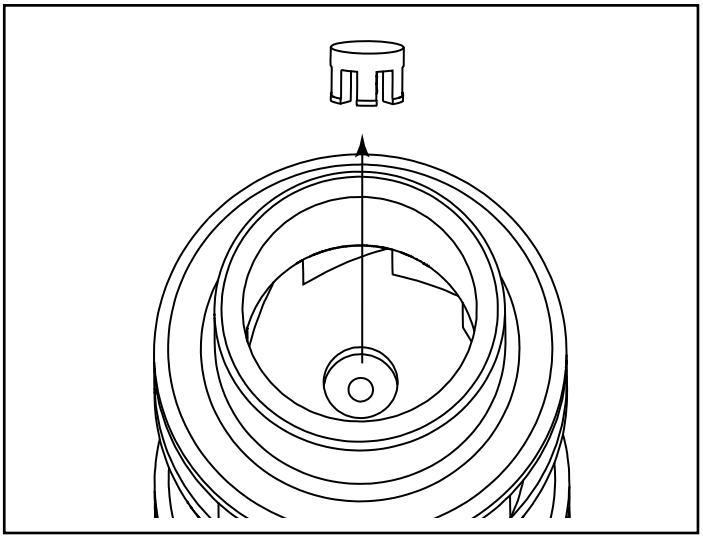

Figure 25 Removing Rotor Filter

11. Remove the rotor filter from the impeller end of the rotor (Figure 25).

NOTE: The rotor filter can be easily damaged during removal and installation. Always have an additional rotor filter on hand in case of damage.

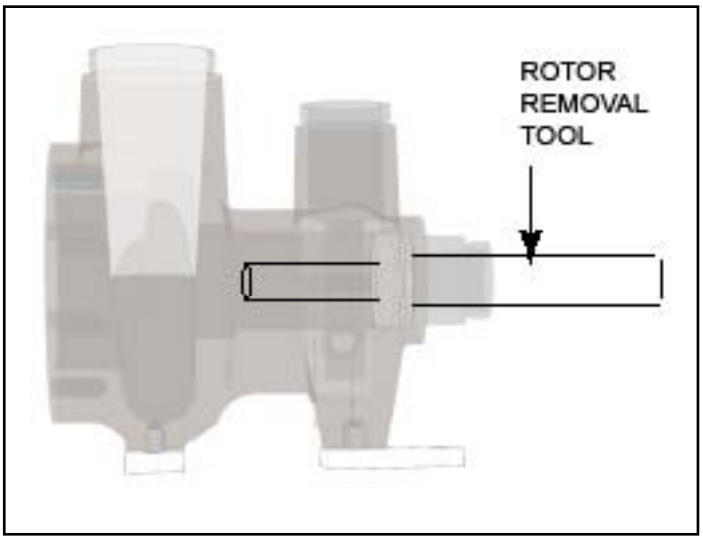

Figure 26 Loosening Thrust Bearing from booster Casing

12. Insert the rotor removal tool (provided), into the brine outlet and gently tap the thrust bearing loose (Figure 26).

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Booster Overhaul (cont.)

13. Remove the thrust bearing with O-ring from the booster casing (Figure 27).

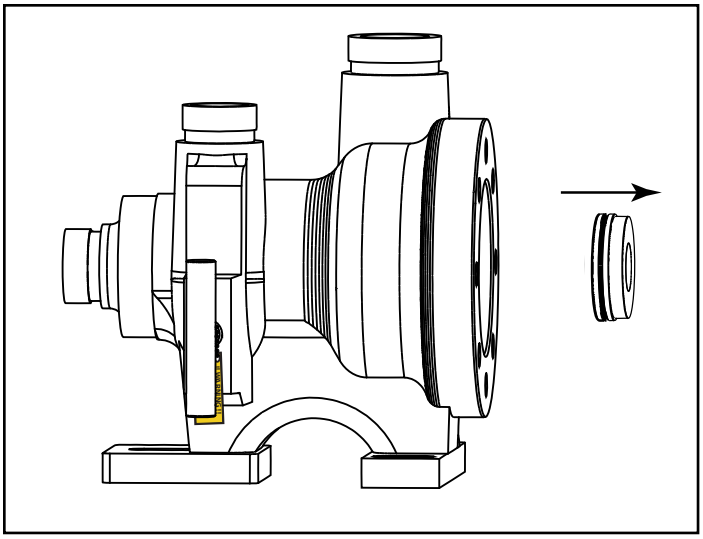

Figure 27 Removing Thrust Bearing

14. Remove the two (2) retaining plate screws (Figure 28).

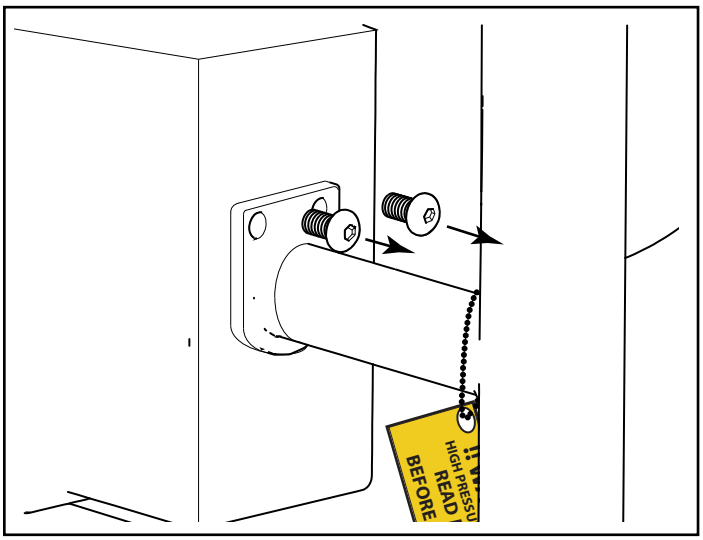

Figure 28 Removing Retaining Plate Screws

15. Rotate the auxiliary nozzle valve to the left (counterclockwise) and remove the auxiliary nozzle valve with retaining plate (Figure 29).

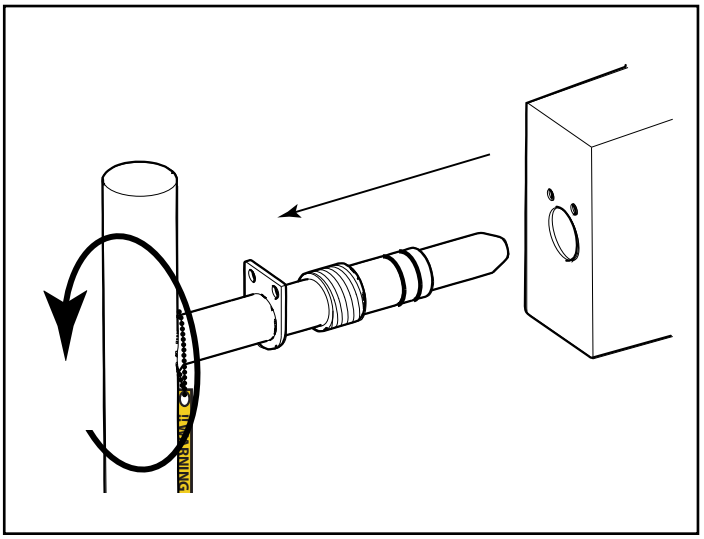

Figure 29 Removing Auxiliary Nozzle Valve

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Booster Overhaul (cont.)

Cleaning

WARNING

NEVER use petroleum or alcohol based solvents when cleaning booster components. Solvents can degrade or damage vital seals and O-rings over time. Use fresh water with mild soap and rinse all components thoroughly with fresh water before assembly.

Rotor
Clean the rotor with soap and fresh water. Rinse thoroughly before use. Pay particular attention to the bearing surfaces and thrust passage ports.

Casing
Clean the casing with soap and fresh water and rinse thoroughly. Pay particular attention to pipe coupling grooves in inlet and discharge connections.

Internal Components
Clean all internal components with mild soap and fresh water. Rinse thoroughly before use. Internal components should dried with a with a clean, damp cloth before assembly.

Inspection

Internal Components
Inspect all internal components for signs of excessive wear or damage. Pay particular attention to bearing surfaces. Replace if necessary.

Fasteners
Inspect all fastener threads for signs of wear or distortion and replace if necessary.

O-Rings
Inspect all O-rings for cuts or damage and replace as necessary.

Bearings
Inspect the thrust bearing and wear ring for signs of excessive wear and replace as necessary.

Rotor
Inspect the rotor and turbine impellers for any cracks or signs of fatigue. Used compressed air to ensure all rotor thrust passages are clear (Figure 39). These passages are responsible for maintaining proper pressure against the thrust bearing and rotor end play. If the thrust passages are blocked and cannot be cleaned, contact a Fedco representative.

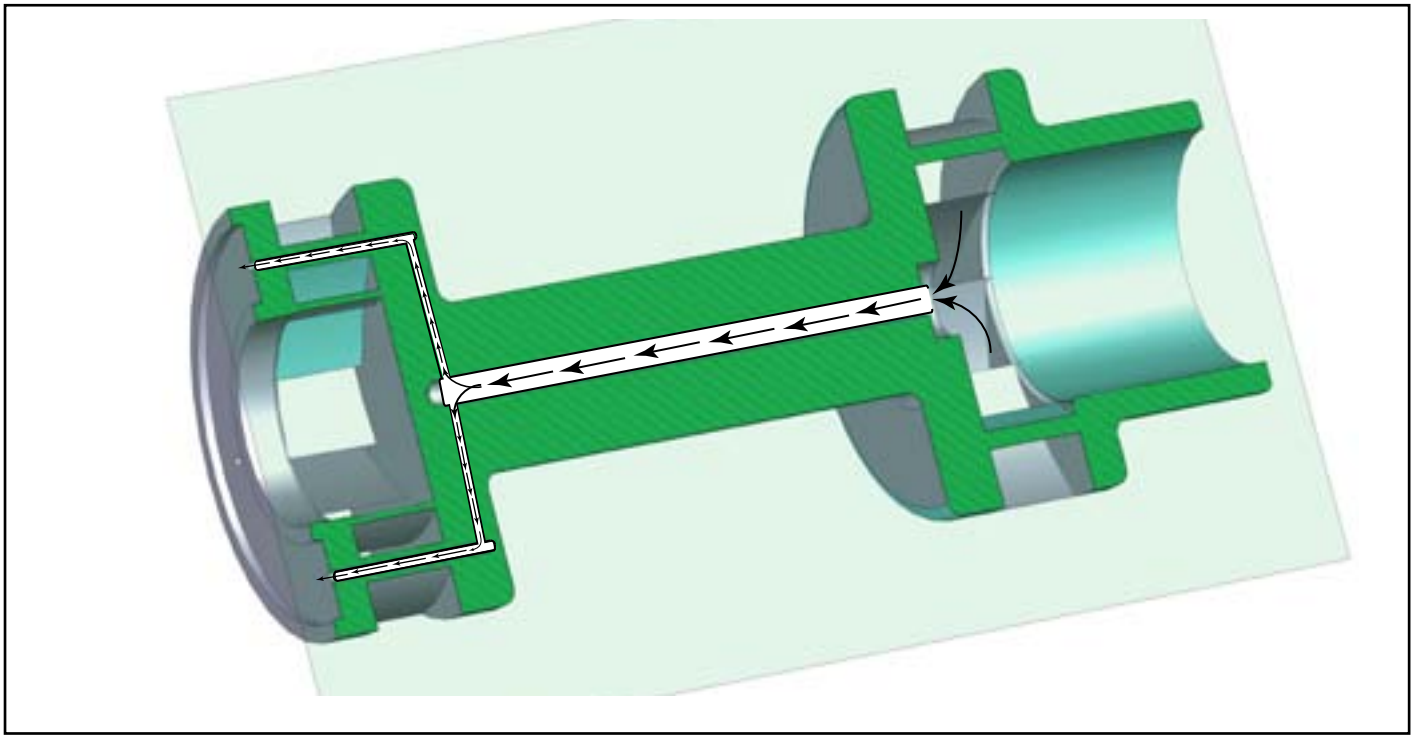

Figure 30 Rotor Thrust Passages

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Booster Overhaul (cont.)

Assembly

1. Apply system compliant anti-seize compound to the valve stem threads and apply lubricant to the valve stem O-rings (Figure 31).

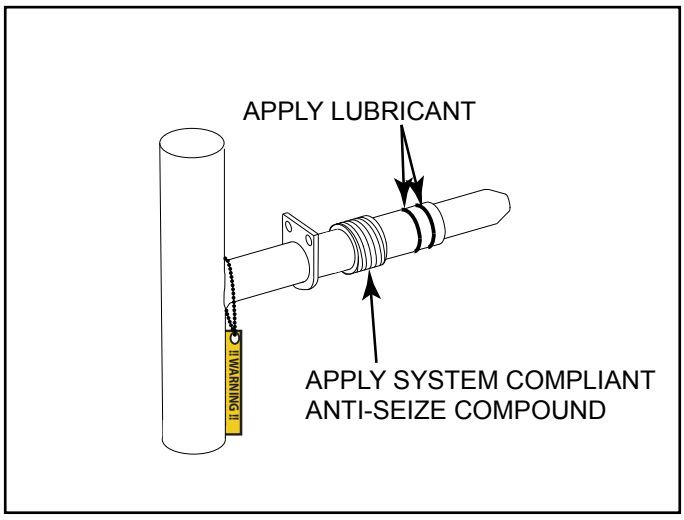

Figure 31 Applying Anti-Seize and Lubricant

2. Rotate the auxiliary nozzle valve to the right (clockwise) and install the auxiliary nozzle valve with retaining plate (Figure 32).

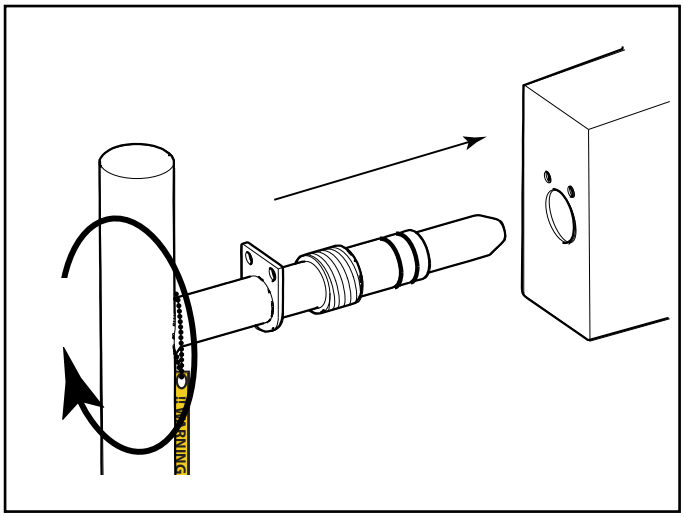

Figure 32 Installing Auxiliary Nozzle Valve

3. Install the two (2) retaining plate screws (Figure 33)

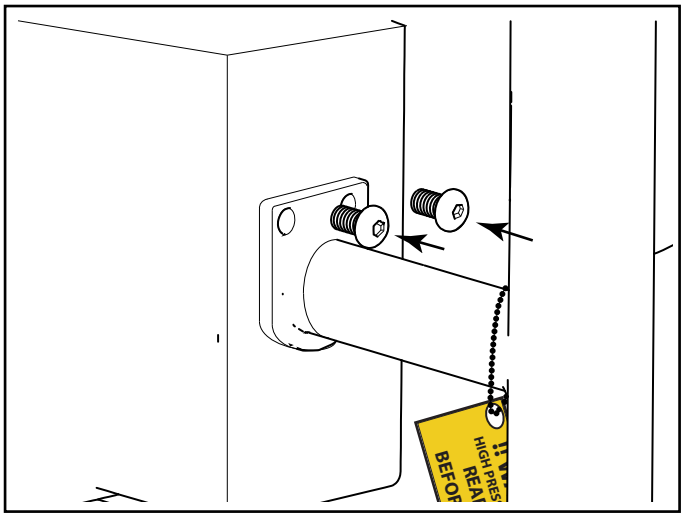

Figure 33 Installing Retaining Plate Screws

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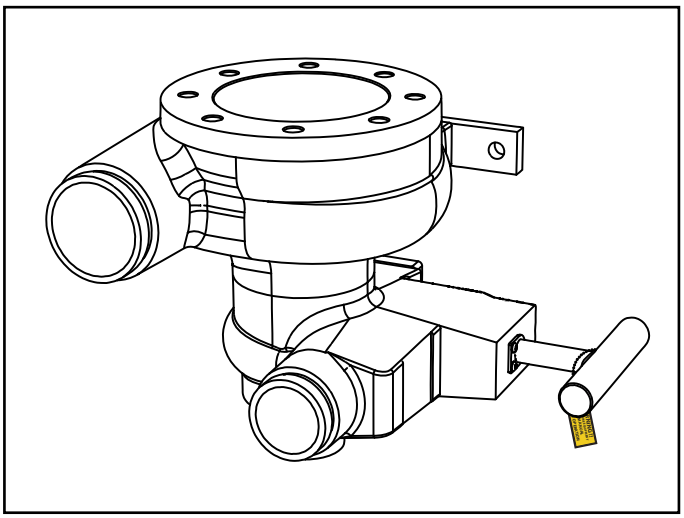

Figure 34 Positioning Casing for Assembly

Booster Overhaul (cont.)

4. Position the casing in an upright position with the end cap opening of the casing facing upward (Figure 34).

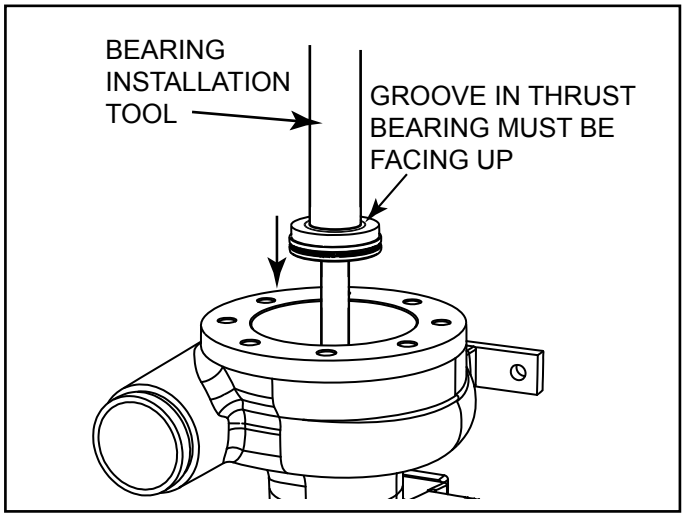

Figure 35 Installing Thrust Bearing on Rotor Removal Tool

NOTE: The groove in the thrust bearing must be facing upward towards the tool shoulder.

5. Place the thrust bearing on the rotor removal tool and lubricate the thrust bearing O-ring (Figure 35).

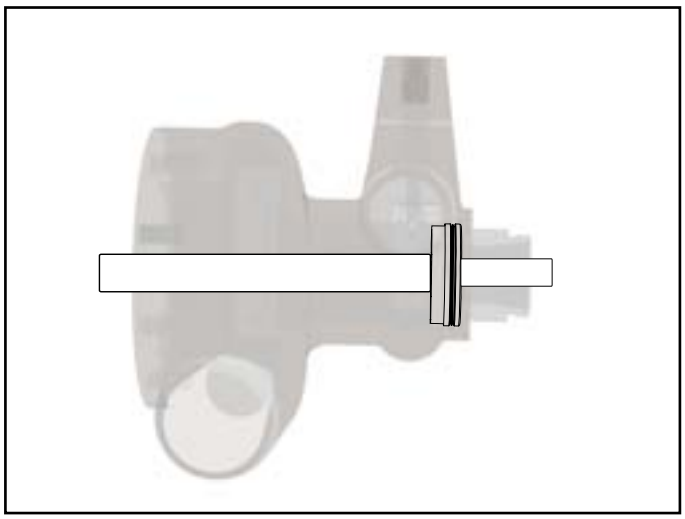

Figure 36 Installing Thrust Bearing

6. Install the thrust bearing into the casing using hand pressure until the thrust bearing seats against the booster casing (Figure 36).

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Booster Overhaul (cont.)

7. Install the rotor filter into the impeller end of the rotor (Figure 37).

   NOTE: The rotor filter can be easily damaged during removal and installation. Always have an additional rotor filter on hand in case of damage.

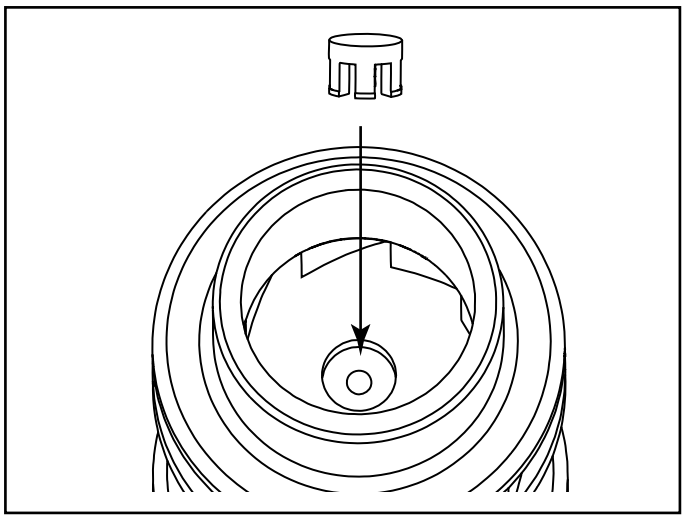

Figure 37 Installing Rotor Filter

8. Lubricate the center bearing O-rings and install the center bearing halves onto the rotor shaft. Secure the center bearing halves with the O-rings (Figure 38).

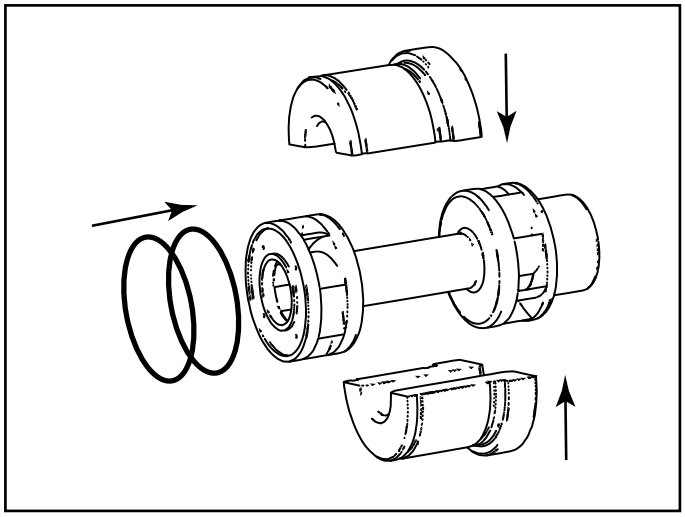

Figure 38 Assembling Center Bearing and Rotor

9. Rotate the rotor in both directions while holding the center bearing stationary. the rotor should rotate smoothly with no drag (Figure 39).

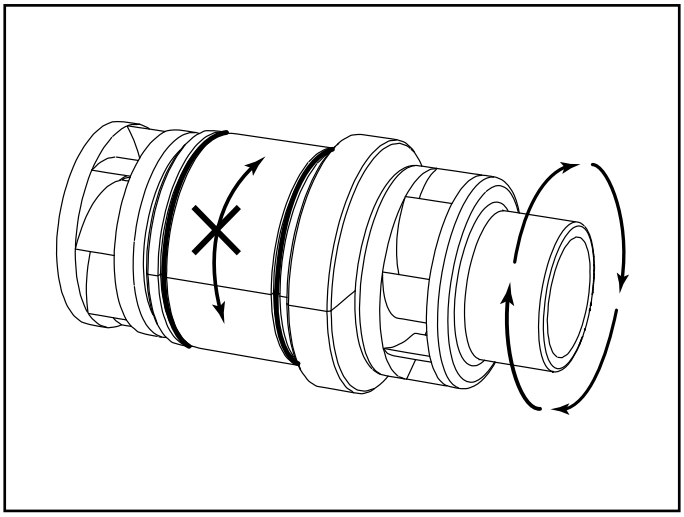

Figure 39 Inspecting Rotor Assembly Rotation

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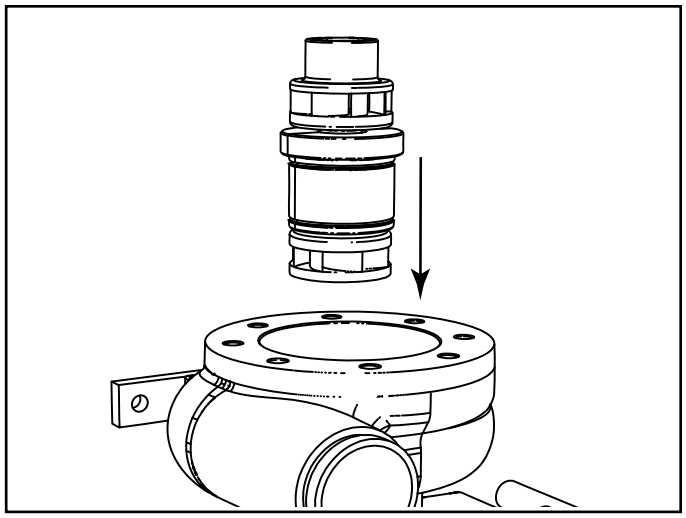

Figure 40 Installing Rotor into Casing

Booster Overhaul (cont.)

10. Install the rotor assembly into the casing with the turbine impeller going in first. (Figure 40).

    NOTE: Make sure the rotor is completely seated against the thrust bearing.

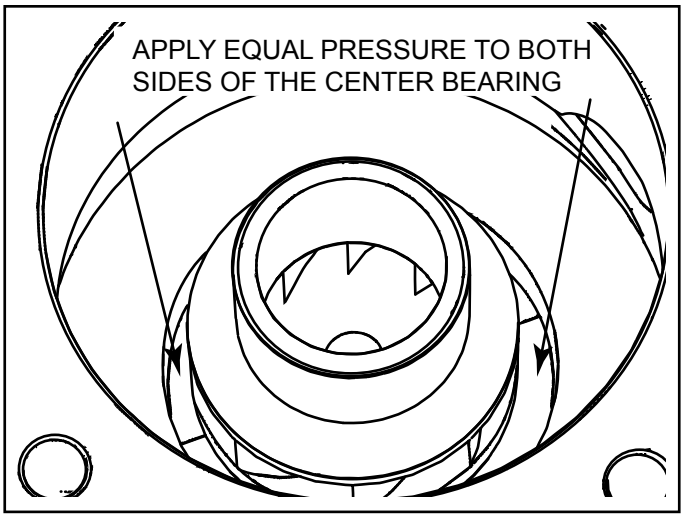

Figure 41 Seating Center Bearing

NOTE: Use even pressure on all sides to properly seat the center bearing and prevent damage to the center bearing O-rings.

11. Using suitable tools and hand pressure, seat the center bearing in the casing (Figure 41).

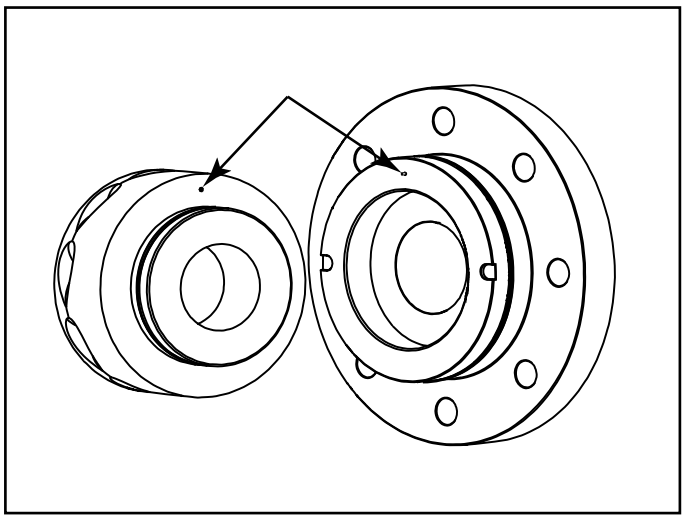

Figure 42 Locating Diffuser Ring Anti-Rotation Pin

12. Locate the diffuser ring anti-rotation pin in the end cap and note the cavity in the diffuser ring (Figure 42).

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Booster Overhaul (cont.)

13. Lubricate the diffuser ring and end cap O-rings and install the diffuser ring into the end cap (Figure 43).

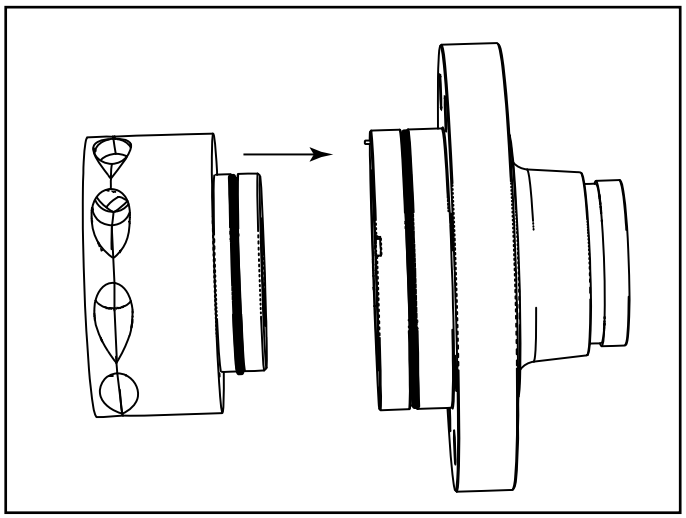

Figure 43 Assembling Diffuser Ring and End Cap

14. Install the end cap and diffuser ring into the booster casing (Figure 44).

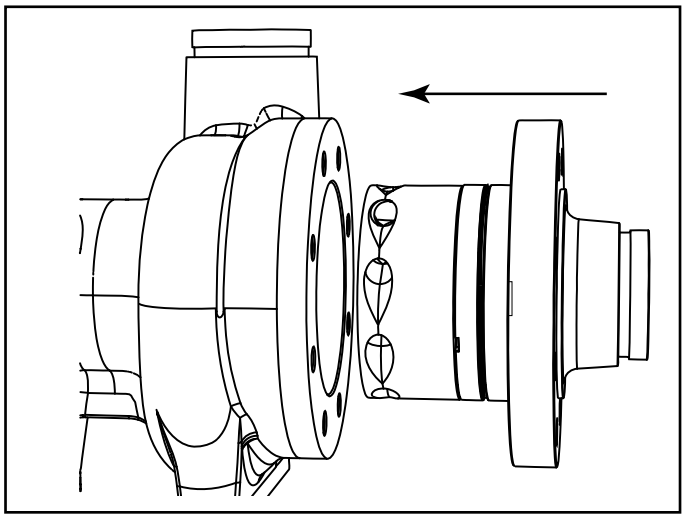

Figure 44 Installing End Cap with Diffuser Ring

15. Secure the end cap with the end cap bolts (Figure 45). Tighten the end cap bolts in a star pattern according to the size bolt used in the chart below.

MODEL	BOLT SIZE	QTY.	TIGHTEN TO:	
HPB-10	1/4-20 X .75	6	7.5	66 Lb-in
HPB-20	3/8-16 X 1	6	12 N-m	9 Lb-ft
HPB-30	3/8-16 X 1 1/4	6	12 N-m	9 Lb-ft
HPB-40	1/2-13 X 1 1/4	6	24 N-m	18 Lb-ft
HPB-60	1/2-13 X 1 1/2	8	24 N-m	18 Lb-ft
HPB-80	5/8-11 X 1 3/4	8	45 N-m	33 Lb-ft
HPB-120	3/4-10 X 2	8	76 N-m	56 Lb-ft
HPB-160	7/8-9 X 2	8	147 N-m	109 Lb-ft

16. Reconnect inlet and outlet piping as necessary and prime booster. Refer to "Preparation for Booster Start Up" earlier in this manual.

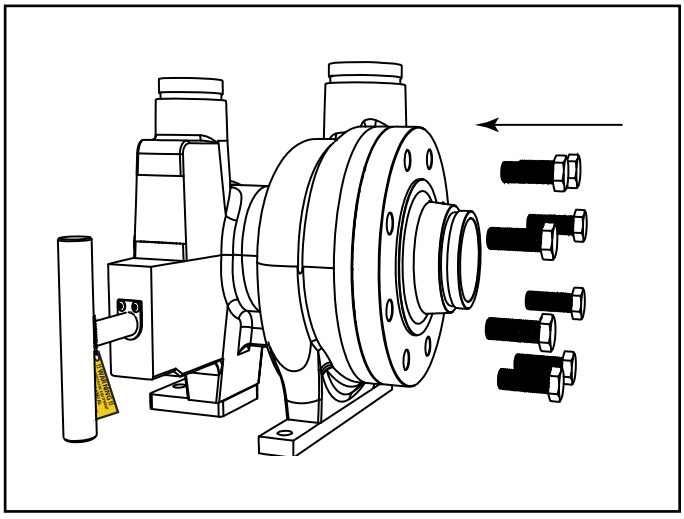

Figure 45 Installing End Cap Bolts

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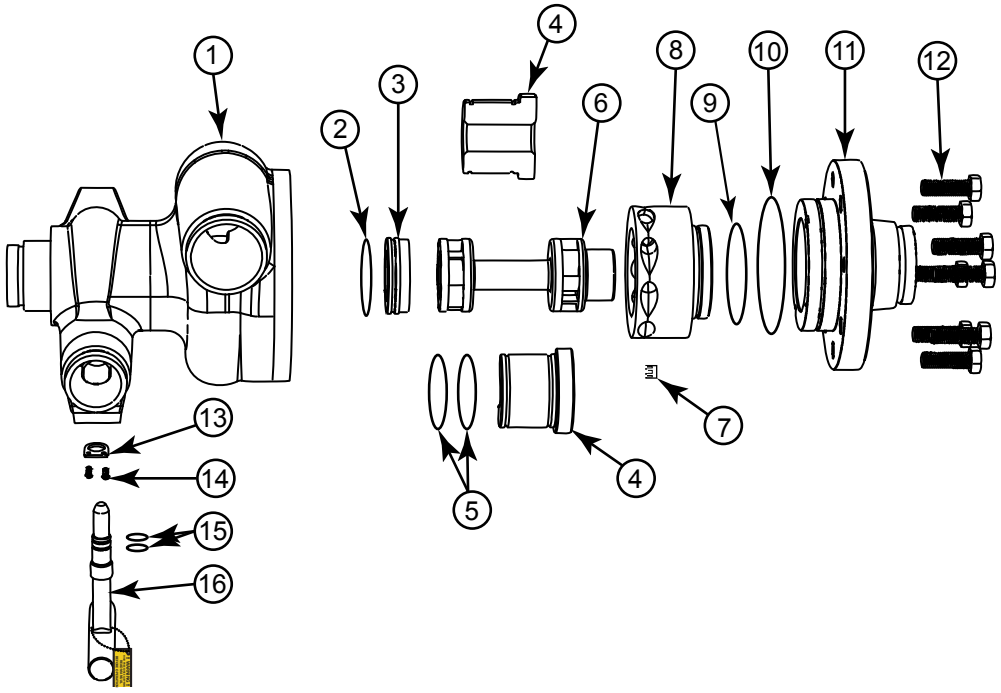
Specifications (cont.)

Components Exploded Views

Booster Components



Item	Description	Item	Description
1	Casing	9	Diffuser O-ring
2	Thrust bearing O-ring	10	End cap O-ring
3	Thrust bearing	11	End cap
4	Center bearing (split)	12	End cap bolts
5	Center bearing O-rings (2 Req'd)	13	Auxiliary nozzle valve retaining plate
6	Rotor	14	Retaining plate screws
7	Rotor filter	15	Auxiliary nozzle valve O-rings
8	Diffuser ring	16	Auxiliary nozzle valve

Figure 46 Booster Components

Ordering Parts

To order a component or service kit, simply contact a FEDCO representative at:

ATTN: Field Service Department
FEDCO
800 Ternes Drive
Monroe, MI 48162
USA

Additional Contact Information:
Tel 734-241-3935
Fax 734-241-5173
Web site: www.fedco-usa.com
Choose the "Service and Support" tab

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Specifications (cont.)

4-5 years of service

A complete disassembly, cleaning and inspection of all booster components is recommended. An overhaul parts kit can obtained by contacting FEDCO.

Service Parts Kits

HPB-10	
Part Number	**Description**
8-H0010-CBK	Center Bearing Kit - Center bearing kit (reduced ID), O-ring kit.
8-H0010-DFK	Diffuser Kit - Diffuser and O-ring kit
8-H0010-OHK	Overhaul Kit - Rotor, diffuser, center & thrust bearing, o-ring kit
8-H0010-ORK	O-ring Kit - Complete set of o-rings
8-H0010-RRK	Rotor Removal Tool Kit - Rotor removal tool
8-H0010-RTK	Rotor Kit - Dynamically balanced, custom rotor
8-H0010-TBK	Thrust Bearing Kit - Thrust bearing, O-ring kit

HPB-20	
Part Number	**Description**
8-H0020-CBK	Center Bearing Kit - Center bearing kit (reduced ID), O-ring kit.
8-H0020-DFK	Diffuser Kit - Diffuser and O-ring kit
8-H0020-OHK	Overhaul Kit - Rotor, diffuser, center & thrust bearing, o-ring kit
8-H0020-ORK	O-ring Kit - Complete set of o-rings
8-H0020-RRK	Rotor Removal Tool Kit - Rotor removal tool
8-H0020-RTK	Rotor Kit - Dynamically balanced, custom rotor
8-H0020-TBK	Thrust Bearing Kit - Thrust bearing, O-ring kit

HPB-30	
Part Number	**Description**
8-H0030-CBK	Center Bearing Kit - Center bearing, O-ring kit.
8-H0030-DFK	Diffuser Kit - Diffuser and O-ring kit
8-H0030-OHK	Overhaul Kit - Rotor, diffuser, center & thrust bearing, o-ring kit
8-H0030-ORK	O-ring Kit - Complete set of o-rings
8-H0030-RRK	Rotor Removal Tool Kit - Rotor removal tool
8-H0030-RTK	Rotor Kit - Dynamically balanced, custom rotor
8-H0030-TBK	Thrust Bearing Kit - Thrust bearing, O-ring kit

HPB-40	
Part Number	**Description**
8-H0040-CBK	Center Bearing Kit - Center bearing, O-ring kit.
8-H0040-DFK	Diffuser Kit - Diffuser and O-ring kit
8-H0040-OHK	Overhaul Kit - Rotor, diffuser, center & thrust bearing, o-ring kit
8-H0040-ORK	O-ring Kit - Complete set of o-rings
8-H0040-RRK	Rotor Removal Tool Kit - Rotor removal tool
8-H0040-RTK	Rotor Kit - Dynamically balanced, custom rotor
8-H0040-TBK	Thrust Bearing Kit - Thrust bearing, O-ring kit

HPB-60	
Part Number	**Description**
8-H0060-CBK	Center Bearing Kit - Center bearing, O-ring kit.
8-H0060-DFK	Diffuser Kit - Diffuser and O-ring kit
8-H0060-OHK	Overhaul Kit - Rotor, diffuser, center & thrust bearing, o-ring kit
8-H0060-ORK	O-ring Kit - Complete set of o-rings
8-H0060-RRK	Rotor Removal Tool Kit - Rotor removal tool
8-H0060-RTK	Rotor Kit - Dynamically balanced, custom rotor
8-H0060-TBK	Thrust Bearing Kit - Thrust bearing, O-ring kit

HPB-80	
Part Number	**Description**
8-H0080-CBK	Center Bearing Kit - Center bearing, O-ring kit.
8-H0080-DFK	Diffuser Kit - Diffuser and O-ring kit
8-H0080-OHK	Overhaul Kit - Rotor, diffuser, center & thrust bearing, o-ring kit
8-H0080-ORK	O-ring Kit - Complete set of o-rings
8-H0080-RRK	Rotor Removal Tool Kit - Rotor removal tool
8-H0080-RTK	Rotor Kit - Dynamically balanced, custom rotor
8-H0080-TBK	Thrust Bearing Kit - Thrust bearing, O-ring kit

HPB-120	
Part Number	**Description**
8-H0120-CBK	Center Bearing Kit - Center bearing, O-ring kit.
8-H0120-DFK	Diffuser Kit - Diffuser and O-ring kit
8-H0120-OHK	Overhaul Kit - Rotor, diffuser, center & thrust bearing, o-ring kit
8-H0120-ORK	O-ring Kit - Complete set of o-rings
8-H0120-RRK	Rotor Removal Tool Kit - Rotor removal tool
8-H0120-RTK	Rotor Kit - Dynamically balanced, custom rotor
8-H0120-TBK	Thrust Bearing Kit - Thrust bearing, O-ring kit

HPB-160	
Part Number	**Description**
8-H0160-CBK	Center Bearing Kit - Center bearing, O-ring kit.
8-H0160-DFK	Diffuser Kit - Diffuser and O-ring kit
8-H0160-OHK	Overhaul Kit - Rotor, diffuser, center & thrust bearing, o-ring kit
8-H0160-ORK	O-ring Kit - Complete set of o-rings
8-H0160-RRK	Rotor Removal Tool Kit - Rotor removal tool
8-H0160-RTK	Rotor Kit - Dynamically balanced, custom rotor
8-H0160-TBK	Thrust Bearing Kit - Thrust bearing, O-ring kit

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Specifications (cont.)

Fastener Torque Specifications

Item	Metric	Standard
End cap bolts (HPB-10)	7.5 N-m	66 Lb-in
End cap bolts (HPB-20 & 30)	12 N-m	9 Lb-ft
End cap bolts (HPB-40 & 60)	24 N-m	18 Lb-ft
End cap bolts (HPB-80)	45 N-m	33 Lb-ft
End cap bolts (HPB-120)	76 N-m	56 Lb-ft
End cap bolts (HPB-160)	147 N-m	109 Lb-ft

Lubricants and Compounds

Lubricant ASTM D1257	Standard Glycerine or fresh water with soap
Anti-seize compound	Compliant with specific system

Foundation Specifications

Refer to "Foundation Specifications" earlier in this manual.

Maintenance

By following the schedule of preventive maintenance presented below, the HPB will deliver years of trouble-free performance.

One (1) day after commissioning

1. Fill out and submit all warranty documentation to FEDCO.

Six (6) months after commissioning

1. Inspect for leaks, damaged gaskets and condition of all pipe couplings.
2. Wipe booster and baseplate with a clean, damp cloth.

Twelve (12) months after commissioning

1. Inspect for leaks, damaged gaskets and condition of all pipe couplings.
2. Wipe booster and baseplate with a clean, damp cloth.

Annually

1. Inspect for leaks, damaged gaskets and condition of all pipe couplings.
2. Wipe booster and baseplate with a clean, damp cloth.

Five (5) Years

1. Annual maintenance per above.
2. Disassemble booster for detailed inspection (refer to "Booster Overhaul").

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Service Policy

Return Authorization Number (RAN)

Please contact a FEDCO representative before returning any equipment. You must have a Return Authorization Number (RAN) issued by FEDCO before we can accept any parts. All returned parts must be shipped prepaid to FEDCO with the RAN clearly marked on the package. We need this number to ensure proper handling of the returned parts and supply of new parts, if needed. Repair by FEDCO on equipment that is out-of-warranty will be warranted for three (3) months. Ask FEDCO for details of the repair warranty. Parts will be replaced in accordance with the FEDCO warranty. Use the following address to return parts:

ATTN: Field Service Department
FEDCO
800 Ternes Drive
Monroe, MI 48162
USA

Additional Contact Information:
Tel 734-241-3935
Fax 734-241-5173
Web site: www.fedco-usa.com
Choose the "Service and Support" tab

Procedure

How to Return Parts to FEDCO

1. Provide FEDCO with the following information:
   - Serial number of unit.
   - Description of why parts are being returned.
2. FEDCO will provide a Return Authorization Number.
3. Pack the unit in the original shipping crate or other suitable crate and clearly mark the Return Authorization Number on the outside of the crate.
4. Send unit, freight prepaid, to FEDCO at the above address.

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Service Policy (cont.)

Warranty

Fluid Equipment Development Company, LLC, (FEDCO), warrants its HPB unit to be free from defects in design, materials or workmanship for a period of 18 months from shipment or 12 months from the date of installation of the product, whichever occurs first, when said product is operated in accordance with written instructions and is installed properly.

If the HPB unit is altered or repaired without prior approval of FEDCO, all warranties are void. All equipment provided by FEDCO, including pump motors, must be installed on a rigid, steel support structure and base capable of handling full loads during operation. Failure to do so will void warranty. All equipment must be installed such that there are no pipe stresses on FEDCO equipment. Failure to do so will void warranty.

If the HPB unit is not installed and aligned as per FEDCO Installation and Operation Manual, any subsequent damage to the booster, pump and/or motor will be excluded from the warranty.

If any defects or poor performance occur during the warranty period, FEDCO's sole obligation shall be limited to alteration, repair or replacement at FEDCO's expense, F.O.B. factory, of any parts or equipment, which upon return to FEDCO and upon FEDCO's examination prove to be defective. All parts returned for warranty service must be shipped prepaid and include FEDCO's return authorization number.

Equipment and accessories not manufactured by FEDCO are warranted only to the extent of and by the original manufacturer's warranty. FEDCO shall not be liable for damage or wear to equipment caused by abnormal conditions, excessive temperatures, and vibration or caused by corrosives, abrasives or foreign objects.

The foregoing warranty is exclusive and in lieu of all other warranties, whether expressed or implied, including any warranty of merchantability or fitness for any particular purpose. In no event shall FEDCO be liable for liable for consequential or incidental damages.

Declaration of Conformity

This product fulfills the obligations of the applicable EU directives. The declaration of conformity is a standalone document and can be requested, if required, from FEDCO or any FEDCO representative.

Register the product warranty at the time of installation by completing the Warranty Registration Form on the following page and sending it to FEDCO.

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Service Policy (cont.)

Warranty Registration Form

THIS FORM MUST BE COMPLETED AND RETURNED TO FEDCO TO ACTIVATE YOUR WARRANTY COVERAGE.

FEDCO will send confirmation of start of warranty coverage

Please FAX this page to FEDCO to register your warranty.
Retain the original for your future information.

FAX to: +734.241-5173 (USA) or E-MAIL: www.fedco-usa.com and choose the "Service and Support" tab.

Initial Installation

Model #: _____ Serial #: _____

Installation Date: _____ Startup Date:_____

VFD frequency (Hz) if used _____ Voltage and Hz of power supply_____

Feed Flow: _____ Discharge Pressure: _____

Comments:

_____

_____

_____

_____

_____

Installed by: _____

Telephone: _____ Fax: _____

E-mail:_____

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Service Policy (cont.)

Start Up Record

Start Up Check List

- ☐ All anchor bolts tightened to specifications.
- ☐ All pipe couplings tightened to specifications.
- ☐ Inlet pressure switch (if applicable) installed.
- ☐ System pipes are clean and upstream filtration in place.
- ☐ System leak checked and all air vented from system.
- ☐ ALL safety devices in place.

Installation and Start-up Information
Start-up Date: _____ Model #: _____
Serial #: _____ Installation Date:_____
Installed By: _____

Operating Conditions
Feed Flow: _____ Suction Pressure to Unit:_____
Discharge Pressure: _____
Drain flow rate (high inlet pressure option only): _____
VFD frequency (Hz) if used _____ Voltage and Hz of power supply_____
VFD Amps: _____VFD Amps (after 48 hours of running time): _____

GENERAL NOTES:
_____

_____

_____

_____

_____

_____

This report has been filled out by: _____Date: _____

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Service Policy (cont.)

Overhaul Record

Overhaul Date: _____

Operating Hours: _____

Reason for Overhaul: _____

_____

_____

Operating Data Prior to Overhaul:
Feed Flow: _____ Suction Pressure to Unit: _____

Discharge Pressure: _____

Operating Data After Overhaul:
Feed Flow: _____ Suction Pressure to Unit: _____

Discharge Pressure: _____

GENERAL NOTES:

_____
_____
_____
_____
_____
_____
_____

Overhauled by: _____

Telephone: _____ Fax: _____

E-mail: _____

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